DEPARTMENT OF THE INTERIOR
Hon. Thomas G. Murphy, *Minister* R. A. Gibson, *Assistant Deputy Minister*
LANDS, NORTHWEST TERRITORIES AND YUKON BRANCH
J. Lorne Turner, Director

CANADA'S EASTERN ARCTIC

Its History, Resources, Population and Administration

Ottawa
J. O. PATENAUDE
Printer to the King's Most Excellent Majesty
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Assembled by W. C. Bethune
for the
Northwest Territories Council

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FOREWORD

BECAUSE of the rapidly increasing interest in the Canadian Arctic with the consequent demand for accurate information we have had assembled data gathered during actual investigations by competent departmental observers and collaborators, or gleaned from authentic reports and where possible verified by government officers. Owing to the quantity of material available it has been necessary to condense it to a considerable degree but without, it is believed, detracting from its usefulness. Acknowledgment is made of the valuable assistance rendered by those who collaborated with the departmental officers in the preparation of the report.

THOMAS G. MURPHY,
Minister of the Interior.

Hon. Thomas G. Murphy, Minister of the Interior.

CANADA'S EASTERN ARCTIC

HISTORICAL

The exploration of no other part of the western world affords a more romantic story than that of Canada's Eastern Arctic, and when it is remembered that the men who sought to break through the barriers of the North were, until comparatively recent years, without the aid of accurate maps or definite information about the territory and its inhabitants, and above all were without steam-power until the middle of the nineteenth century, we cannot but admire their skill, courage, and endurance, and record our high estimation of the results which they achieved.

The history of Arctic exploration might very well begin with Pytheas, the Greek navigator who about 330 B.C. sailed from Massilia, the modern Marseilles, near the mouth of the Rhone, discovered the British Isles, and possibly reached as far north as the coast of Norway, where he secured information regarding lands still farther north. Norwegian colonists in Greenland or Iceland may have visited Baffin island, and Ericsson almost certainly landed on the coast of North America about the year 1000. Columbus' belief that a passage westward to Asia existed resulted in his voyage to America in 1492. Cabot followed and on his second voyage in 1498 may have coasted as far north as Hudson strait. Evidence is lacking as to the course actually followed.

From that time on the sources of information regarding the visits of Europeans to the Arctic are less likely to have been misinterpreted. The stories have been published many times, and it is not possible within the scope of a report such as this to mention more than a few of the outstanding expeditions. During the Elizabethan period—so rich in literature, feats of daring on the sea, and romance—the British nation commenced the exploration of the vast area to the north of the American continent. After the fact of a continental barrier to a direct westward passage to the Orient was accepted, rumours of a "Northwest Passage" again became current. Following some fifteen years' effort to secure the necessary backing Frobisher, through the assistance of the Earl of Warwick, set out in 1576. He sailed north and entered a bay in southern Baffin island to which his name has been given. Two more-pretentious expeditions followed, in 1577 and 1578, during which formal possession of the lands discovered was taken, and during which the ships were laden with cargoes of ore believed at the time to contain gold. In 1585-87 Davis touched farther north on Baffin island, entered Cumberland sound, and crossed the easterly end of Hudson strait to that landmark at the northerly point of Labrador, which he named cape Chidley. In 1610 Henry Hudson entered the strait and bay which now bear his name, giving the name of Wolstenholme to the cape on the mainland at the west end of the strait. He was forced to winter in James bay, and on his way home his crew mutinied, abandoning Hudson together with his young son and sick members of the crew in a small boat.

Hudson was followed in 1612 by Sir Thomas Button who explored the west coast of Hudson bay to the mouth of the Nelson; in 1615-16 by Robert Bylot and William Baffin who sailed north of 78°, naming Smith sound between Ellesmere island and north Greenland; by Jens Munk who wintered at the mouth of the Churchill in 1619 and by James and Foxe in 1631 who completed the exploration of the west coast of Hudson bay; by Middleton in 1742-43; by Moore and Smith in 1746; by Pickersgill in 1776 and by Young in 1777.

While more attention was now given to the extension of knowledge in the various branches of science, the finding of a northwest passage was still the goal which Arctic expeditions sought to reach. Parry, one of the greatest of Arctic discoverers, made three worthy and well planned attempts to get through. In 1819-20 he entered Lancaster sound and penetrated as far west as Melville island, which he named. In 1821-23 he entered Hudson strait and explored the district around Repulse bay at the southerly end of Melville peninsula, and Fury and Hecla strait. In 1824-25 he again tried to find a westward passage from the Lancaster Sound area. Sir John Ross spent four winters at Boothia peninsula—1829-33; James Ross, a nephew, later Sir James Ross, was a member of the expedition and discovered the Magnetic Pole in the spring of 1831.

We now come to an event in the history of Canada's Eastern Arctic which aroused widespread public interest, interest which has not altogether died out, and which resulted in the discovery of much new territory in the Canadian Arctic Archipelago and the exploration of thousands of miles of coastline. In addition a northwest passage was discovered and traversed from west to east by M'Clure, although he did not get his ship through. In 1845 Sir John Franklin sailed with the *Erebus* and *Terror* through Lancaster sound, Barrow strait, around Cornwallis island, and wintered at Beechey island. He later sailed down Peel sound and Franklin strait and was caught in the ice. The ships had to be abandoned off King William island. Franklin had died before the ships were abandoned. All his officers and men died either on board ship or while trying to reach help. In 1848 anxiety as to the fate of the expedition began to be felt and a relief expedition under the command of Sir James Ross was sent out. This was followed by many other search parties. Captains Austin and Penny discovered Franklin's winter quarters in 1850 but secured no information as to the direction taken from there. Dr. J. Rae after spending the winter of 1853-54 at Repulse bay brought home the first tidings and relics of the Franklin party, and in 1858 Lieut. W. R. Hobson, who accompanied Capt. F. L. M'Clintock in the *Fox*, found a note in a cairn on the west side of King William island indicating that Franklin had died on June 11, 1847, that the *Erebus* and *Terror* had been abandoned, and that the remaining members of the expedition had made for Back's Great Fish river, now known as Back river. Incidentally M'Clintock was one of the first to make extensive and worthwhile use of the sledge in winter travelling in the Arctic. Some of the winter trips during which the sledges were pulled by hand without the use of dogs were really remarkable. M'Clintock himself made one sledge trip extending over 105 days and covering 1,408 statute miles. Although hope of finding any members of the Franklin party still alive had been abandoned, the search for additional information did not end here and can hardly be considered as closed even now. As late as 1930 Major L. T. Burwash, then an officer of the Department of the Interior, on duty in the North was instructed to carry out certain investigations on King William island which were considered desirable in view of information laid before the Dominion Government. The investigations were made and are reported in a departmental publication "Canada's Western Arctic."

Exploration continued, the lure in many cases being the discovery of the North Pole. In 1882, however, plans were completed for the first International Polar Year. The different nations interested established stations in the Arctic for the purpose of taking synchronous scientific observations. One of the stations was established by Lieut. (later General) Greely for the United States and was located on Lady Franklin bay in northern Ellesmere island. Valuable records were obtained, and the hardships endured as reported by the surviving members of the expedition are well known. This station was not occupied dur-

ing the second International Polar Year, 1932-33. The Germans also occupied a station during the first Polar Year in the territory covered by this report, their post being located on Cumberland sound, Baffin island, under the command of Dr. W. Giese.

During the years 1898-1902 Captain Otto Sverdrup carried out explorations and scientific investigations on Ellesmere island and islands to the west. The latter group of islands, frequently referred to as the " Sverdrup group," he and his party discovered. In appreciation of the value of the scientific work carried out by Commander Sverdrup in this section of the Canadian Arctic archipelago the Canadian Government within comparatively recent years granted him a sum of money.

In 1903 Roald Amundsen, the noted Norwegian explorer, set out with a small party in the auxiliary power schooner *Gjoa* for the purpose of carrying out magnetic observations in the vicinity of the North Magnetic Pole, and of attempting to make the Northwest Passage. He passed through Lancaster sound, and down the west side of Boothia peninsula, taking up winter quarters near the southeastern angle of King William island at a harbour which he named Gjoa Haven. This served as his headquarters for two winters. He then continued westward along the mainland to King point near Herschel island where he was forced to spend a third winter, sailing out through Bering strait in 1906. The Northwest Passage had been accomplished, but not without difficulty. Amundsen in his book " The Northwest Passage " comments on his good fortune in getting through, with comparative ease, places that were impassable to former navigators. He also expressed appreciation of the explorations of Dr. John Rae and Admiral Sir Leopold M'Clintock, and the valuable information thereby made available respecting the waters traversed by himself.

Peary's discovery of the North Pole occurred on April 6, 1909. He was followed in 1926 by Admiral Byrd, who flew over the pole in an aeroplane and a few days later the pole was crossed by Amundsen, Ellesworth, and Nobile, who flew in a dirigible from Spitsbergen to Alaska. In 1928 Nobile again flew over the pole in a dirigible which was wrecked on the way back, but Nobile and most of his crew were ultimately saved. Amundsen was lost while searching for the Nobile party. Wilkins and Eielson flew across the Arctic from Alaska to Spitsbergen in 1928.

Of the more recent expeditions to the Eastern Arctic which have made worthwhile contributions to science, in addition to those sponsored by the Government of Canada, mention might be made of the Fifth Thule Expedition 1921-24, in charge of the late Knud Rasmussen, Ph.D., the result of which have been published in a number of papers issued from time to time.

HUDSON'S BAY COMPANY

The history of the Hudson and James Bays area would be incomplete without reference to the Hudson's Bay Company; indeed the early history of that district and the story of the company's first trading operations are largely coincident.

Strange as it may seem, two Frenchmen, Radisson and Groseilliers, were principally responsible for the formation of this thoroughly British corporation. Although young they were experienced in the American Indian trade, and their ambitious natures early led them into difficulties with the local authorities. The Governor of New France fined them heavily for illicit traffic in furs, and an effort to obtain restitution in France failed. This placed them in a position where they were unable personally to finance a trading expedition to that great northern sea of which they had heard from Indian friends, and which they may even have visited. Ultimately they were induced to seek financial backing in

England. The time was apparently ripe for such enterprises and they succeeded in interesting sufficient English capital to equip two small vessels. On approaching Hudson strait, in 1668, the master of one of the vessels lost heart and returned to London. The other vessel, the *Nonsuch*, continued to the south end of James bay. Here, near the mouth of Rupert river, they built Fort Charles, and carried on a profitable trade with the Indians, returning the next year to England loaded down with furs.

FORT PRINCE OF WALES NEAR CHURCHILL, MANITOBA

The inscription on the bronze tablets placed near the entrance to the fort reads: "Fort Prince of Wales. Built upon plans drawn by English military engineers to secure control of Hudson Bay for the Hudson's Bay Company and England. Construction commenced in 1733 and completed in 1771. Surrendered to and partially destroyed by a French naval force under La Perouse in 1782. Its ruins are among the most interesting military remains on this continent." The tablets were erected in 1931 by the Department of the Interior.

The success of the enterprise resulted in the granting by charter in 1670 to Prince Rupert and associates of the sole trade within the entrance to Hudson strait, together with all the lands, mines, fishes, etc., not possessed by any other British subject, or the subject of any other Christian Prince or State, and in addition created "the said Governor and Company, for the time being, and their successors, the true and absolute lords and proprietors of the same territory, limits, and places aforesaid." After the granting of the charter Radisson and Groseilliers returned to James bay, establishing a second trading fort. The Company expanded intermittently until by the nineteenth century they were to all intents and purposes "absolute lords" of that vast and then little known and inadequately described district, Rupert's Land.

However, the Company did not remain in undisputed possession of this area during all that time. The first challenge to their suzerainty occurred in 1686, in which year the French undertook an overland expedition to James bay, capturing the forts at the mouths of the Rupert, Moose, and Albany rivers. The Sieur d'Iberville proved a scourge to the Company both on land and sea. Altogether the French had much the better of the armed conflicts in this area, but they were not as successful as the Company in the conduct of the fur trade.

By the Treaty of Utrecht in 1713 Hudson bay was ceded to England, but about thirty years later hostilities broke out afresh between England and France. Fort Prince of Wales at the mouth of the Churchill river fell in 1782 without a shot being fired, and was destroyed by the French. York Factory fell under similar circumstances and this ended armed conflict on the part of Europeans in the Hudson and James Bays area. With the fall of Quebec the territory again came under the British Crown. There was still to be armed strife in other districts between employees of the Hudson's Bay Company and its competitors.

By the deed of surrender signed November 19, 1869, the Company gave up all rights of government, proprietary rights, and all other privileges, granted by the original letters patent. It still continues to carry on trade amongst the Indians and Eskimos, and its ships have been sailing into Hudson bay for over 260 years.

One of the purposes given for the granting of the first charter was that exploration might be encouraged. The Company met its obligation in this regard to some extent, but mostly in areas to the west. Dr. Rae, whose good work was commented on by Amundsen, as referred to above, was an official of the Hudson's Bay Company, as were also Dease and Simpson, and at an earlier period Samuel Hearne.

ACQUISITION OF THE NORTHWEST TERRITORIES BY CANADA

By an Imperial Order in Council dated June 23, 1870, Great Britain transferred to the recently confederated Dominion her adjacent possessions in North America known as Rupert's Land and the North Western Territory, and stipulated that the combined area should be known as "The Northwest Territories." A second Imperial Order in Council of July 31, 1880, confirmed the transfer of all Great Britain's islands in the North American Arctic Archipelago to the Dominion of Canada.

In 1869 an "Act for the temporary government of Rupert's Land and the North Western Territory when united with Canada" was passed by the Canadian Parliament and immediately upon the union taking place in 1870 a small portion of the newly acquired territory, including the Red River Settlement, was organized as the Province of Manitoba and admitted to Confederation. The Lieutenant-Governor of Manitoba was made Lieutenant-Governor of the Northwest Territories, from year to year for a period of five years.

In 1875 the Canadian Parliament passed "The Northwest Territories Act," which provided for a more permanent form of government for the Territories. A resident Lieutenant-Governor was appointed and provision was made for a Council which should in time become a Legislative Assembly with a maximum number of twenty-one members. The seat of government was fixed for a time at Battleford and in 1883 changed to Regina, but the first meeting was held at Livingstone, near the present town of Swan River.

Step by step, as circumstances demanded, the further organization of the Northwest Territories was effected. The process involved the creating of various districts and territories, the boundaries and forms of administration of which were revised from time to time to keep abreast of development.

The District of Keewatin was created in 1876 and withdrawn from the Government of the Northwest Territories. The boundary of Manitoba was considerably enlarged in 1881. The Districts of Assiniboia, Saskatchewan, Alberta, and Athabaska were created in 1882 and those of Ungava, Franklin, Mackenzie, and Yukon in 1895. Yukon was made a separate territory in 1898. Adjustments of the boundaries of Quebec and Ontario were made from time to time.

In 1905 the Provinces of Alberta and Saskatchewan were created, their northerly boundaries being fixed as the 60th parallel of north latitude. They swallowed up the Districts of Assiniboia, Saskatchewan, Alberta, and Athabaska the only districts having representation in the Northwest Territories Legislature.

As regards the area outside the new provinces the territorial form of government in force since 1875 was discontinued and in its place provision was made by "The Northwest Territories Amendment Act 1905," for the appointment, by the Governor in Council, of a chief executive officer to be styled and known as the Commissioner of the Northwest Territories, who should administer the government of that area under instructions from time to time given him by the Governor in Council or the Minister of the Interior. Provision was made for the appointment of a Council of six members or less, as deemed desirable, to aid the Commissioner. The seat of government was fixed at Ottawa.

On the same day on which the Provinces of Alberta and Saskatchewan came into existence (September 1, 1905), the District of Keewatin was reannexed to the Northwest Territories.

Claims for a greater share of territorial lands were renewed by the older provinces of Quebec, Ontario, and Manitoba and in 1912 the Dominion Government acceded to their requests. The boundaries of Quebec were enlarged to include all of the former Rupert's Land south of Hudson strait and Ungava bay and east of Hudson and James bays. Ontario and Manitoba were given the remainder of these lands on the south and west shores of Hudson and James bays as far as the 60th parallel of north latitude. Thus by the year 1912, the original area of the Northwest Territories had been cut down to that of the present day—slightly over 35 per cent of the total area of Canada.

By an Order in Council of March 16, 1918, becoming effective on January 1, 1920, the boundaries of the Districts of Mackenzie, Keewatin, and Franklin were revised and defined as now existing.

GOVERNMENT INVESTIGATIONS

Since the transfer of the administration of the Northwest Territories from the Hudson's Bay Company to Canada over 60 years ago a number of expeditions have been sent North by the Federal Government for the purposes of exploration and scientific investigation. The Department of Marine and Fisheries organized the following expeditions:—

1884, Neptune; 1885 and 1886, Alert.—Navigation in Hudson strait, the fisheries of the district, and the geology of the surrounding territory were studied.

1897, Diana.—Commercial whaling stations in Cumberland sound were inspected and reported on to the Department.

1903-04, Neptune.—A winter base was established at Fullerton harbour on the mainland north of Chesterfield inlet. The following summer the expedition which was commanded by A. P. Low of the Geological Survey of Canada sailed through Hudson strait and north to Smith sound. From there the expedition turned south, entered Lancaster sound and proceeded to Beechey island. Somerset island was also visited on the way out and the expedition returned to Fullerton harbour before proceeding to Halifax. Geological, topographical, and meteorological investigations were carried out as well as studies in natural history. The report of the expedition is contained in a comprehensive publication, "The Cruise of the Neptune" 1903-04.

1906-07, C.G.S. Arctic.—Captain J. E. Bernier was in charge of this expedition. The lands along Lancaster sound, Barrow strait, and Melville sound were

visited. The ship returned to Albert harbour in Pond inlet where the expedition wintered. The report is contained in the publication "Cruise of the Arctic" 1906-07.

1908-09, C.G.S. Arctic.—Captain Bernier again commanded the expedition and carried out the duties of Fisheries Officer. The following waters were patrolled—Smith sound, Lancaster sound, Barrow strait, Melville sound, M'Clure strait. During the winter stay at Winter harbour, Melville island, land

IN HUDSON BAY IN 1845

Barques "Prince Albert" and "Prince Rupert", Hudson's Bay Company's trading vessels, off Mansel island, Hudson bay, July 31, 1845.

(Courtesy Hudson's Bay Company)

parties were sent to Banks island and Victoria island. On the voyage back Byam Martin channel and Austin channel on the west and east side respectively of Byam Martin island were sounded, and Hudson strait entered to ascertain the state of navigation. The expedition had in its personnel a meteorologist, a geologist, and a naturalist. The report of the expedition is contained in a rather complete publication "Cruise of the Arctic" 1908-09.

1910, C.G.S. Arctic.—Surveys and discoveries were made in and about Bylot island, Admiralty inlet, Brodeur peninsula, and as far south as the western end of Fury and Hecla strait. Meteorological and geological investigations were conducted. The report is contained in "Cruise of the Arctic" 1910.

From 1910 until after the War there was a comparative lull in Government investigations in the Eastern Arctic, although rather intensive studies were carried out in the Western Arctic during that period. An increase in interest resulting in a growth in travel necessitated a more intensive administration and since and including the year 1922 the Department of the Interior has sent an expedition to the Arctic annually, transportation being furnished by the following ships:—

1922-25, inclusive, C.G.S. *Arctic;*
1926-31, inclusive, ss. *Beothic*;
1932, ss. *Ungava,* and
1933, ss. *Nascopie.*

During this time investigation of landing fields and flying conditions was undertaken. Geological, biological, botanical, meteorological, parasitological, medical, and economic investigations were carried out. Certain harbours and post sites were surveyed and investigations made with respect to the Eskimos and the game upon which they depend for food and clothing. Trading posts were visited, Police posts established, resupplied, and personnel changed from time to time.

Special investigations have been conducted by officers of the Department of the Interior and the Department of Mines on Baffin island during the winter months. Reference may be made to the publications "Southern Baffin Island" and "Breeding Grounds of the Blue Goose" issued by the Department of the Interior; to "A Faunal Investigation of Southern Baffin Island," "The Geology of Parts of Eastern Arctic Canada," (*Summary Report of the Geological Survey, 1925*), and "Cumberland Sound Area, Baffin Island," (*Summary Report of the Geological Survey, 1927*) issued by the Department of Mines. The narrative of the expeditions for the years 1922-26 inclusive are included in a booklet "Canada's Arctic Islands," issued by the Department of the Interior. Reports of subsequent expeditions were not published separately but are made very briefly in the Annual Reports of the Department of the Interior. Nominal charges are made for some of these reports.

LOCATION AND EXTENT

The Northwest and Yukon Territories embrace all of the mainland of Canada west of Hudson bay and north of the 60th parallel of North latitude; all of the islands in Hudson and James bays and in Hudson strait including Ungava bay; and all of the Arctic islands north of the mainland of Canada. These northerly islands have been defined as those within the area bounded on the east by a line passing midway between Greenland and Baffin, Devon and Ellesmere islands, to the 60th meridian of longitude, following this longitude to the Pole, and on the west by the 141st meridian of longitude, following this longitude to the Pole.

The Northwest Territories may be briefly and roughly said to be that portion of the mainland of Canada and the vast Arctic Archipelago lying north of the provinces and east of the Yukon Territory. The estimated total of land and fresh water areas of the Northwest Territories is 1,309,682 square miles.

The Northwest Territories are divided for the purposes of administration into three districts:—

Mackenzie District.—That portion of the mainland lying between Yukon Territory and the 102nd meridian of longitude.

Keewatin District.—That portion of the mainland exclusive of Boothia and Melville peninsulas between the 102nd meridian of longitude and Hudson bay, together with the islands in Hudson and James bays.

Franklin District.—Boothia and Melville peninsulas and all islands in Hudson strait and Arctic waters except those adjacent to the Yukon coast.

Of the above three districts this report is concerned only with portions of Keewatin and Franklin. The Eastern Arctic is a very indefinite term, but in departmental parlance has come to mean that portion of Northern Canada that is patrolled annually by the Eastern Arctic Expedition, together with those areas not visited annually which could normally be reached more readily from the east than they could from the west. The west coast of Hudson bay might very well be included under this heading, but it has been described in another departmental publication entitled "Keewatin and Northeastern Mackenzie." That portion of the Ungava peninsula, north of the tree-line, might also come under the term Eastern Arctic but it is under the jurisdiction of the provincial authorities of Quebec. The administration of Eskimo affairs in Quebec is for the time being looked after largely by the Department of the Interior under a temporary arrangement with the province.

Islands in the Eastern Arctic

The areas of the principal islands in the Eastern Arctic according to estimates prepared in the Topographical and Air Survey Bureau, Department of the Interior, follow:—

HUDSON AND JAMES BAYS

The areas of the islands in Hudson and James bays are based on the following maps: Department of Marine map of James bay, 1915, scale 1:507,140; Geological Survey maps, 1902, scale 8 miles to 1 inch, sheets I, II, and III; Topo-

graphical and Air Survey Bureau map of Belcher Islands, 1933, scale 4 miles to 1 inch; Chief Geographer's 35-mile map.

Island	Square Miles	Island	Square Miles
Akimiski	898	Coats	1,544
Charlton	113	Southampton	16,936
Belcher Islands	1,096	Smaller islands (estimated)	1,810
Mansel	1,317		

Total area, Hudson and James bays.....23,714

NORTH OF HUDSON BAY

The islands north of Hudson bay, and lying north and east of a line across Rae isthmus through Bellot strait, Franklin strait, M'Clintock channel, Viscount Melville sound, and M'Clure strait, as measured on the Chief Geographer's 35-mile map, 1930, and National Development Bureau 60-mile map 1929, are as follows:—

Island	Square Miles	Island	Square Miles
Baffin	201,600	Brock	414
Nottingham	441	Borden	4,068
Salisbury	490	Lougheed	504
Akpatok	551	Isachsen	1,008
Resolution	1,029	Ellef Ringnes	3,258
Bylot	4,968	Amund Ringnes	1,764
Somerset	9,540	Meighen	360
Prince of Wales	14,004	Cornwall	720
Devon	20,484	Axel Heiberg	13,248
Cornwallis	2,592	Ellesmere	75,024
Bathurst	7,272	Smaller islands (estimated)	8,782
Melville	16,164		
Eglinton	504	Melville Peninsula	24,156
Prince Patrick	6,696		
		Total	419,641

TOPOGRAPHY

The bulk of our knowledge of the topography of the Arctic has been gained from coastal observation, augmented by information obtained from time to time from scientific expeditions which have penetrated the interior at selected locations, from police patrols, and from native and other hunters. Although much more study and investigation is needed to fill in details, from the sources just mentioned enough knowledge has been gained, piece by piece, to form a fair idea of the main topographical structure of most of the area.

The coast of Labrador and northern Quebec may be described as a table-land having an elevation of 1,500 to 2,000 feet above the sea. The interior plateau over an area of 200,000 square miles is a rolling country in which the differences of elevation rarely exceed 350 to 500 feet, and the higher elevations do not exceed 2,500 feet above sea level. On the Atlantic coast the land rises abruptly from the sea in stupendous cliffs increasing in height toward the north to a point 70 miles south of cape Chidley. The mountains come close to the coast at this point and the land rises to 5,000 and 6,000 feet—the highest land east of the Canadian Rockies—from here the height decreases until at cape Chidley it falls to 1,500 feet or less.

The shore of Ungava bay is low, but from cape Hopes Advance to cape Wolstenholme the coast rises again and continues for 270 miles lofty and bold, 500 to 2,000 feet high all along the south coast of Hudson strait.

On the eastern shore of Hudson bay the coast is low, excepting between Portland promontory and cape Jones, where a range of mountains 1,000 to 2,000 feet high approaches close to the shore for 350 miles.

The George and Koksoak rivers flowing into Ungava bay and Great Whale, Fort George, Eastmain, and Rupert rivers flowing into the east side of Hudson and James bays are the principal rivers.

The southern coast of Baffin island is over 400 miles in extent. It is indented with many bays and inlets. The land rises abruptly from the coast. Inland from the eastern part of the coast is seen Grinnell glacier, glistening and white. Towards the western end of Hudson strait, the coast, although bold, is not so high. This shoreline from Big island to Chorkbak inlet is fronted by an archipelago of islands and rocks extending from 15 to 20 miles from the coast.

DEVON ISLAND

Photograph taken at Dundas Harbour indicating the rugged nature of the island.

Baffin island is the largest in the Arctic Archipelago. It fronts the strait and bay between Canada and Greenland, with an eastern coastline which is generally high and rocky, with many deep inlets and bays. The land rises quickly from the sea to an elevation of upwards of a thousand feet, and then more gently to the summit of an interior table-land. In the southern area, a height of from two to three thousand feet is reached, and to the north of Cumberland sound on the eastern side of the island, a general elevation of 5,000 feet, with occasional prominences of perhaps one or two thousand feet above this. The north coast is extremely rough and broken, rising in the interior to a general elevation of about two thousand feet. The western shoreline—fronting on Foxe basin—is for the most part low. The western interior of the northern half of the island comprises a country of rough plains, and rolling hills interspersed with numerous lakes,—a grazing area for caribou.

Frobisher bay, extending westerly from near the southeast corner of Baffin island, is about 150 miles in length with a width of 25 miles between rugged sides. There are many islands at the upper end where, according to the British Admiralty publication "The Arctic Pilot," tides of 45 feet rise and fall. Grinnell glacier extending along the peninsula south of Frobisher bay is from 70 to 100 miles long, possibly 20 miles wide. Cumberland sound slightly over 100 miles north of Frobisher bay is the largest inlet on the east coast of Baffin island. It is 140 miles long and 40 miles broad. Bylot island is separated from Baffin island

by Pond inlet, Eclipse sound and Navy Board inlet. Admiralty inlet to the west of Navy Board inlet extends southerly for nearly 200 miles from Lancaster sound.

Ellesmere island, the third largest of the whole archipelago, with an area of approximately 75,024 square miles is nearly as large as England and Scotland combined. It is remarkable for the fact that its northern end reaches to within 500 miles of the North Pole and, on account of its nearness to the northwestern coast of Greenland. For a distance of 450 miles its northeastern shoreline is separated from that of the latter country by a narrow strait which in several places does not attain a width of more than ten or fifteen miles. The general elevation of the interior is probably over two thousand feet, with mountains at its northern end. Along the western side of the island, low plains, extending from the seashore for many miles inland to the base of the interior cliffs, afford grazing ground for caribou and musk-ox.

Devon island, like Baffin and Ellesmere islands, shows its boldest face to the eastward. With an elevation of nearly 3,000 feet on the side facing Baffin bay an interior table-land gradually loses height further westward. Low coastal plains toward the southwestern end of the island form grazing lands for game.

The Parry islands lying to the west of Ellesmere and Devon, although among the last of the groups in the archipelago to be discovered, are now comparatively well known owing to the intensive searches carried on in that quarter in the endeavour to discover traces of Sir John Franklin's ill-fated expedition. Their shorelines are very broken, the land rising in cliffs 400 to 700 feet high. The general elevation of the interior of these islands is well under a thousand feet, the inland plateau being broken up by many cross-ravines, which render overland travel extremely difficult.

Hudson bay lies entirely to the south of the Arctic Circle, and, according to the Department of Marine, is approximately 930 miles in length between its extreme latitudes with a maximum width of 520 miles; its total area, exclusive of James bay, Mansel, Coats, and smaller islands, is given as 246,000 square miles. Its principal connection with the ocean is via Hudson strait. It is the central drainage basin for the North American continent, draining the country on the east from the Labrador coast; on the south from the headwaters of the Red river (about latitude 45°), and on the west from the Rocky mountains; in all a drainage area of almost a million and a half square miles.

ACCESSIBILITY

Navigation Seasons

The Eastern Arctic is, for practical purposes, accessible only by water and air. The first expedition recorded in this report as having been sent to the Eastern Arctic by the Canadian Government following the taking over of the Northwest Territories from the Hudson's Bay Company was primarily for the purpose of studying navigation and fisheries in Hudson strait. These investigations were continued more or less regularly, but following the decision of the Dominion Government to complete the Hudson Bay railway and terminals, the safety of navigation on the Hudson Bay route was taken up on a more elaborate scale. The Departments of Marine and National Defence collaborated in 1927-28 in an aerial survey of ice conditions in the strait from bases which were established at Port Burwell, Wakeham bay, and Nottingham island. The Canadian Hydrographic Service, in its publication, "Sailing Directions for the Hudson Bay Route," states: "From the records obtained during the past three years, 1929 to 1931, it appears that the period during which vessels could have safely navigated Hudson strait and bay extended from July 25th to October 31st."

As might be expected, the navigation season north of Hudson strait opens somewhat later than in the strait. The dates on which bays and harbours are clear of ice vary. An unfavourable wind may hold the ice in for an extra week or ten days. On the other hand, favourable conditions may clear it out a week or so before the average date.

As no aerodromes have been built in the Arctic as yet, the seasons during which aircraft may operate to-day are controlled largely by,

1. The hours of daylight in the Arctic.
2. The latitude of the area over which the flight is made.
3. The relationship between the seasons in the Arctic and the seasons in the country to the south.

There are periods in the spring and fall during which water areas in the north are frozen over and during which summer flying conditions exist farther south. Planes equipped for winter flying can get north as long as winter conditions exist at the fields from which they take off. Seaplanes cannot expect to land in the Arctic before the opening of navigation, and a risk of being damaged by new ice is run if they are operated towards the end of September. Excluding ice caps, glaciers, and valleys where the snow has accumulated during the winter, land areas may be expected to be clear of snow before there is open water.

Water Routes and Water Transportation

The extension of the Hudson Bay railway to Churchill, Manitoba, and the Temiskaming and Northern Ontario railway to Moosonee, Ontario, has had the effect of making the Eastern Arctic more readily accessible to Canadians living in Central and Western Canada. The oldest route, and that still usually best suited for operations from points in Eastern Canada, is by ship along the Labrador coast, and thence either through Hudson strait or through Davis strait to the most northerly outposts. Ocean-going vessels with passengers and cargo for the James bay terminal of the Temiskaming and Northern Ontario railway stop at Charlton island and make contact with Moosonee by vessels of lesser draught. The Hudson's Bay Company have a warehouse at Charlton island which serves as a base of supplies for their trading posts throughout that district.

Although the port of Churchill is used by grain carriers, the Hudson's Bay Company is the only company at present providing regular transportation service to the Eastern Arctic. The ss. *Nascopie*, which was specially constructed for work in northern waters, is used for the principal distribution of freight and passengers, while smaller vessels continue the service to ports not visited by the *Nascopie*. The Revillon Freres Trading Company also have small craft which are used for the same purpose, but principally to serve their own trading posts. In addition, it is usually possible to charter an Eskimo sail-boat or power-boat and crew. These boats are often quite seaworthy and the natives make excellent seamen and mechanics. Some northern travellers prefer using a freighting canoe with an outboard motor. This is undoubtedly a good way to travel in fair weather in certain areas where it is possible to take refuge quickly, but one should always secure the services of a capable Eskimo (or if working in James bay, an Indian) guide. The trading companies do not usually carry more than sufficient motor fuel at each post to meet the normal requirements of their own districts. Information can be had of course from the trading companies as to the chances of securing gasolene or oil in quantity at any particular post.

Hudson Bay Route

The desire of the western provinces for a grain outlet on Hudson bay and the action of the Dominion Government in taking measures to give that route

every possible chance of proving a success were responsible for the extra effort on the part of the Canadian Hydrographic Service to secure full information as to navigation conditions in Hudson strait and bay, and on that of the Department of Marine to install the necessary aids to navigation in those waters.

The Canadian Hydrographic Service of the Department of Marine, which is responsible for the charting of the coastal and inland waters of Canada, publishes a number of general, coast, and harbour charts of Hudson strait, Hudson bay, and James bay. During the past season (1933) an extensive stretch of the southeastern coast of Baffin island was charted. Available charts are listed in the "Catalogue of Marine Charts" issued by the same service.

The following radiotelegraph and direction-finding stations are operated by the Department of Marine continuously during the season of navigation. Watch is maintained on 600 metres (500 K/cs). Direction-finding bearings are dealt with on 800 metres (375 K/cs) after communication has first been established on 600 metres.

Station	Call Signal	Position	
		Latitude N	Longitude W
Port Churchill	VAP	58° 46′ 32″	94° 10′ 31″
Nottingham island	VCB	63° 06′ 48″	77° 56′ 18″
Cape Hopes Advance	VAY	61° 05′ 12″	69° 33′ 24″
Resolution island	VAW	61° 18′ 30″	64° 53′ 24″
Chesterfield inlet	VBZ	63° 20′ 05″	90° 42′ 33″

A large and powerful patrol vessel of the ice-breaker type, the *N.B. McLean,* equipped with salvage apparatus, is stationed in Hudson strait during the season of navigation. This steamer is completely equipped with radiotelegraph and radio telephone apparatus and maintains constant watch on a wave-length of 600 metres (500 K/cs), call letters being C.G.S.N. Information as to her exact whereabouts may also be had by communicating with one of the stations in the strait. The Department of Railways and Canals maintains two tugs at Churchill. One of these is equipped with salvage plant.

Navigation lights have been established on Resolution island, cape Hopes Advance, Wales island, east and west ends of Charles island, Nottingham island, Cary's Swan Nest on Coats island, and on Hubbart point on the west coast of Hudson bay.

ICE CONDITIONS

Ice conditions may vary somewhat from year to year but from the numerous reports of explorers and whalers as well as from Government expeditions sent specially to investigate the matter, much data have been assembled. In "Sailing Directions for the Hudson Bay Route" already referred to, information is furnished as to tidal streams and ice on the Hudson Bay route. "The Arctic Pilot," Volume III, issued by the Hydrographic Department of the British Admiralty contains a wealth of information of a similar nature relating to Davis Strait, Baffin Bay, Smith Sound and the passages within the Canadian Archipelago, as well as to the waters of the Hudson Bay route. The report of "The Marion Expedition to Davis Strait and Baffin Bay," published by the United States Treasury Department is also a work of reference which anyone interested will find well worth reading and keeping in mind.

The general flow of the currents in the Eastern Arctic is southward along the east coast of Ellesmere, Devon, and Baffin islands, and the Labrador peninsula.

In Hudson strait the water circulation is predominently westward along the northern side, and eastward along the southern part of the strait. In Hudson

bay a similar anti-clockwise flow is found, the southward movement of waters along the west side veering eastward in the lower part of the bay and joining the streams on the east side that are indicated on the charts as constantly moving northward. There is probably a return northwestward in the region of Mansel island by a division of these waters, but in part at least, the flow continues around cape Wolstenholme and eastward out the south side of Hudson strait. The general flow through the Eastern Canadian Arctic islands is to the east, and also south through Foxe channel.

Additional information pertaining to these northern waters will be found in the "Tide Tables for the Atlantic Coast of Canada," issued each year by the Hydrographic Service of the Department of Marine.

A Northern Iceberg

An iceberg photographed during the 1933 patrol. Field ice may be seen in the left background.

The Aeroplane in the Arctic

A great deal of valuable experience has been gained within the past few years in winter and summer flying in the mainland portion of the Northwest Territories, and aircraft services in the Mackenzie District seem to be there to stay. However, in the Eastern Arctic aircraft have been used only to a limited extent. It is true that the Royal Canadian Air Force had a party of flyers stationed in Hudson strait during the years 1927-28, that Belcher islands and the east coast of the mainland from the Belcher islands south have been photographed from the air, also that mining companies have used aeroplanes in the area. Nevertheless the plane has not yet found its "niche" in the economic structure of the Eastern Arctic. The reason undoubtedly is that the natural resources so far uncovered have not attracted sufficient capital, or have involved the handling of too much heavy freight.

That there are difficult flying problems peculiar to the Arctic Archipelago area is undoubtedly true. In the low lying regions land and ice-covered water areas have a tendency to blend with the sky during the winter months and a

pilot requires a working knowledge of navigation to get about. Winter flying has been carried out along Hudson strait as intimated in the foregoing paragraph and in addition winter conditions in the Mackenzie District where planes carry passengers, mail, and freight all winter parallel closely many of the conditions existing in the same season in the Eastern Arctic. Squadron Leader R. A. Logan of the Royal Canadian Air Force joined the 1922 Eastern Arctic Expedition for the purpose of studying, during the summer, flying problems in the Canadian Arctic Archipelago and since leaving the Service has continued his investigations in a commercial way. He favoured the use of aeroplanes fitted with skis which could be changed for wheels, rather than seaplanes or flying boats. The presence of many small pieces of ice, almost invisible, adds a hazard to landing in the water, although there are many places, particularly from midsummer to fall, when this extra hazard is not present to any extent. Of course, a small seaplane might be used for comparatively short flights from a steamer base.

Aerial View of Trading Posts at Repulse Bay

(Photo by Royal Canadian Air Force)

Generally the earth's surface in the Eastern Arctic is rocky and rough with a generous scattering of glacier-deposited boulders. The tendency is for the surface to flatten out towards the west in the archipelago and towards the south in the Hudson bay region. In the more northerly areas particularly there is very little soil, but where soil exists deep water-saturated moss and other Arctic vegetation will usually be found. Raised beaches and gravel beds at the feet of glaciers might enable forced or emergency landings to be made at some places, and of course there are some fairly flat sea-level beaches, valleys, and plateaus. Most of these areas would require improvement for other than unavoidable use, and many could hardly be classed as fit for use even in an emergency. Major

Logan expressed the opinion that emergency landings could be made on ice caps, the tops of glaciers, and large ice pans. Great care would have to be exercised in unfamiliar districts because the size of the gravel or broken rock is often very deceiving at a distance, and the nature of the snow or ice hard to determine in spite of the long shadows cast by the sun in northern latitudes.

The heat of the sun begins to be felt in June and the ice rots quickly; accompanied by a wind the pans are soon broken up to too great an extent to enable an aeroplane to land thereon. When there is little or no wind the pans will naturally hold together longer, but the ice becomes honeycombed and the surface covered with pools of water.

After having made some flights in 1925 from a base at Etah, Greenland, Admiral Byrd, in speaking of flying over Polar regions, stated, "Scarcity of landing places over both land and water forms one of the chief dangers to the flyer. A forced landing means a crash and the possibility that the crew will not be able to walk away from the wreck."

As for the utility of the aeroplane in the Eastern Arctic there is no question, in spite of the emphasis given to the attendant dangers. Its use enables one to get a whole season's work done without wintering in the north, it makes accessible districts that could not otherwise be readily reached, and enables the quick reconnaissance of very large areas. This, in addition to the invaluable service it provides as an instrument of a mapping organization.

The part which the Canadian Arctic will play in future Europe-to-Asia flights is not yet known. It is in the direct line of the shortest flight from London or Paris to Japan, and the saving in miles has been recognized for years. However, the problem of intermediate landings, forced or intentional, in what may be an inhospitable district is one which has not yet been solved, and the impossibility of obtaining advance weather reports at all but a few points adds greatly to the hazard.

(With this section might be read the section on the Climate and Weather of the Eastern Arctic.)

The Compass in the Eastern Arctic*

It is a well-known fact that the compass does not point to the astronomic or true north, but more or less to the east or west at different places; also that the declination (the amount it points to the east or west of true north) at any place does not remain the same from year to year. It also changes from hour to hour throughout the day. This latter change is called "diurnal inequality" or "daily variation," while the first-named change is called the "secular variation."

In order to determine the declination and the amount of the secular variation of the compass at various points in the Eastern Arctic, Hudson and James bays, and Hudson strait, the reports of explorers for the past 300 years have been carefully examined and whenever observations for declination have been made they have been noted in the records of the Topographical and Air Survey Bureau, Department of the Interior. As a result some 450 observations in these northern islands have been tabulated. These results, while they give a lot of very valuable information, are not sufficient to accurately determine the changes mentioned above. Most of the determinations have been made along the various coastlines, only a few being taken inland, and some were taken on the ice at sea.

Some idea of the changes in declination at different places may be obtained from the fact that the declination of the magnetic needle at the south end of James bay is about 17° west of north. As one goes north, the declination

* Contributed by C. S. Macdonald, D.L.S., Topographical and Air Survey Bureau, Department of the Interior.

increases rapidly. At Hudson strait the magnetic needle points about 45° west of north. At the north end of Ellesmere island (according to observations taken in 1876) the magnetic declination is about 102° to 115° W., that is the magnetic needle points not to the north but about 65° to 78° west of south. As one approaches the North Magnetic Pole, situated on Boothia peninsula, the magnetic compass becomes more unsteady and unreliable. Under these conditions, a solar compass is the only simple method by which bearings can be determined. With this instrument, provided the sun is visible and one's latitude and approximate time are known, it is possible to determine bearings closely enough for all practical purposes.*

During 1928 an exploratory engineer of the Department of the Interior was detailed to carry out certain investigations in the vicinity of Boothia peninsula. The Topographical and Air Survey Bureau took advantage of this expedition to secure much data of value in determining the action of the magnetic needle. The amount of the secular variation has been determined (for 1925) at the following points and in the amount specified: Niantilik, on southwest shore of Cumberland sound, 6:3 E. annually; Nottingham island, near the western end of Hudson strait, 3:5 W. annually; Marble island near Ranken inlet on the west side of Hudson bay, 3:5 W. annually; Ashe inlet on Upper Savage island in Hudson strait, 6:3 E. annually.

The map showing lines of equal magnetic variation and annual change for 1932 also gives recent information as to the above in the southern part of the Eastern Arctic. It is distributed by the Topographical and Air Survey Bureau.

Winter Travel

The common method of travel in the Arctic during the winter months is by dog sledge, which is briefly described in the sections on Eskimos and Eskimo Dogs. So far as the natives are concerned there is no present indication of any likely change. In some areas a team may be picked up readily, in others the animals may have to be secured individually as opportunity offers, from different natives. The services of experienced Eskimos are necessary as guides, for the purpose of securing dog feed, for the construction of over-night snow-houses, and unless one is familiar with the handling of dogs, as dog drivers. The number of dogs in a team and the number of teams necessary depend largely on the load to be carried and the length of the journey.

*The gyroscopic compass, with which many of the steamers operating on the Hudson Bay route are equipped, is uninfluenced by proximity to the magnetic pole.

CLIMATE AND WEATHER OF THE EASTERN ARCTIC

By W. E. Knowles Middleton, M.Sc., Meteorological Service of Canada, Department of Marine.

This brief survey is intended to cover that part of the Dominion lying north of the 55th parallel and east of the 85th meridian. The territory thus defined includes Ellesmere island, Devon island, Bylot island, Baffin island and the northern part of the Ungava peninsula, all land surfaces of great extent. Practically all the permanent habitations of white men in this area are on the seacoast, so that our information is almost entirely limited to the coast, while all that is known of the climate and weather of the interior is contained in the occasional records of explorers.

Records for two years or more are available for the following stations within the geographical limits mentioned above:—

Port Burwell, Quebec	Lat.	60° 25′ N.	Long.	64° 48′ W.
Great Whale River, Quebec		55 17		78 20
Fort Chimo, Quebec		58 10		68 10
Port Harrison, Quebec		58 25		78 21
Cape Hope's Advance, Que		61 05		69 33
Resolution Island, N.W.T		61 18		64 53
Lake Harbour, Baffin Island		62 48		69 51
Nottingham Island		63 07		77 56
Pangnirtung, Baffin Island		66 07		65 31
Pond Inlet, Baffin Island		72 42		78 19
Dundas Harbour, North Devon Island		74 34		82 10
Craig Harbour, Ellesmere Island		76 12		79 35
Bache Peninsula, Ellesmere Island		79 04		76 18

In most cases these records are of pressure, temperature, precipitation, wind and weather, observed either two or three times daily. If the former, the hours are 8 a.m. and 8 p.m., 75th meridian time; if the latter, the additional observation is taken at 2 p.m. Until quite recently all these observations were made by eye, but during the last few years instruments for the continuous recording of wind and pressure have been supplied to some of the stations.

The fundamental difficulties in obtaining satisfactory records from these northern stations are two. First, it is rare that any observer will remain at a post more than two or three years, and thus the valuable quality of continuity of method is likely to be absent from the records. Second, communication with most of the posts, especially those in the Arctic Archipelago, is limited to one ship a year, so that there is no opportunity of correcting the mistakes and omissions of an observer until two years after he began observing, by which time he will probably be transferred. However, in spite of these not inconsiderable handicaps there is available a body of information of apparent accuracy, which enables us to form a fairly detailed picture of the climate and weather of the northern coasts of the Dominion.

In the interpretation of the records of any meteorological station it is always necessary to bear in mind the topography of the surrounding country. Nowhere is this more necessary than in Arctic latitudes. The topography of the Arctic Archipelago has been abundantly described in this series of reports, though it is difficult for one who has not visited the region to appreciate the *scale* of the country. The posts, with few exceptions, are situated in the most sheltered harbours available, for obvious reasons of convenience and comfort; but unfortunately the meteorological records are not generally representative of the region for this very reason.

The elements most affected by such sheltered exposures are wind, temperature, and precipitation. It will be obvious that where a station is situated in a narrow valley there will be a tendency for the winds to blow up and down the valley; and at any station on the coast where the land has an appreciable slope, land-and-sea breezes will occur, especially in summer, which will represent a purely local effect and will not correspond with the general movement of air over the region. Thus during the visit of the *Nascopie* to Craig Harbour in 1933 a strong land breeze down the glacier developed during the evening, while the sea two miles or less from the post was perfectly calm.

The same causes which lead to local winds also lead to local variations in temperature. In order to understand this, it is necessary to remember that whenever air is moved down from a higher level to a lower, it automatically becomes warmer by about $4\frac{1}{2}$ degrees Fahrenheit for each 1,000 feet it descends. Thus air which has flowed off such an ice cap as is found on Ellesmere island reaches sea-level with a temperature much higher than the real temperature on the ice. Similarly, ascending air is cooled, which leads to heavier precipitation at the base of mountains on their windward sides; this is known as orographic precipitation, and is demonstrated on a gigantic scale on the western coast of Canada, where the Rockies force air to ascend many thousands of feet.

The peculiar situations of the northern posts, then, must lead us to accept the results of meteorological observations as applying to the seacoast, and in some cases to sheltered harbours, rather than to the whole region, and to exercise great care in drawing maps of the meteorological elements. Winds are likely to have favoured directions, mean temperatures to vary rapidly as one proceeds inland from the coast, especially in winter, and precipitation to be heavier on the coast than in the interior.

WINDS

As we begin to discuss the winds, the force of the above remarks is fully brought out. At Bache Peninsula, for example, the winds in winter are predominantly from the northeast, and in summer from the southeast. It is probable that this does not represent a real circulation of air over the region, but that the prevalence of northeast winds in winter is due to drainage of air down a ravine behind the post. This explanation is supported by the fact that nearly all the winds in winter at this place are very light (97 per cent of them less than 12 miles per hour), and that 80 per cent of all the observations in winter show calms. This prevalence of calms during winter is a feature of all stations in the Far North, and in general the records show that the higher the latitude of the station, the greater the percentage of calms. At Pond Inlet, about 30 per cent of the winter observations, and at Lake Harbour about 10 per cent are thus recorded; this may well be compared with Saint John, New Brunswick, a coastal station in 45° 17′ north latitude, where the corresponding figure is 2·7 per cent. During the polar night, very strong cooling of the lower layers of the atmosphere takes place from below by radiation, causing temperature to increase instead of decrease with height. Thus, the cold air below being much heavier than the warmer air above, a very stable layer is produced in the first few hundred feet. Turbulence in this being next to impossible, the velocity of the upper layers cannot be communicated to the layers nearest the surface. The process is aided by the fact that the surface is covered with snow, which is an extremely efficient radiator of long waves into space.

At stations such as Pangnirtung and Lake Harbour, which are situated in long, narrow fiords, the wind observations can only be interpreted as mainly local winds blowing up and down the fiord. Only a strong pressure gradient at right angles to the valley can overcome the tendency of the winds to use the

valley as a channel. Such stations are therefore of little use in determining the general movement of air over the region. In addition to the confining effect of the valley walls, a strong "chinook" effect at times manifests itself at such stations. When this happens, a very strong wind down the valley will be accompanied by a rapid rise in temperature. On one such occasion at Pangnirtung a strongly built warehouse was unroofed, indicating a velocity of at least 100 miles per hour.

At a station such as Craig Harbour, at the foot of a glacier, the cooling action of the ice produces steady land breezes in summer. These are often colder than the air they displace at sea-level, as was the case during the visit of the *Nascopie* to Craig. If the tendency of the air to flow down the glacier valley is added to a suitable pressure-gradient, local winds of astonishing force may result. This occurred during the second and third days of the *Nascopie* visit, when the wind in the harbour reached 60 miles per hour at times, while the wind outside, as indicated by the appearance of the sea in the distance, could scarcely have been stronger than half that velocity.

In periods of fine weather, such as frequently occur during the summer in these regions, a station near the coast will experience land-and-sea breezes of the ordinary type. Such a condition is well illustrated at Port Burwell, as the following table will show:—

Season	Hour	Percentage of winds from sector NE-S	Percentage of winds from sector SW-N
		%	%
Summer	8 a.m.	64	36
	8 p.m.	39	61
Winter	8 a.m.	30	70
	8 p.m.	26	74

It will be seen that the percentages are interchanged during the summer, but that during the winter, when both land and sea are covered with ice and snow, there is practically no difference between the two hours of observation.

At the stations on Hudson strait the winds are predominantly from the west, but numerous strong winds occur from all directions. Indeed, the strongest winds are often easterly at Resolution island and at Nottingham island. Hudson strait is well within the zone of travelling depressions, which explains the well-distributed nature of the winds. In the season of navigation the winds are for the most part light and variable, with occasional storms of only moderate intensity. It is rare to find a summer storm lasting more than two days or at the most three, and there are many periods of calm weather.

As far as can be determined from the few records available, the winds of the eastern coast of Hudson bay give similar evidence of the marked cyclonic activity in the neighbourhood. At all seasons there is a good distribution of the winds around the compass, the stormiest periods being the spring and fall. In summer and winter, extended spells of fine weather and light winds occur.

Owing to the local conditions explained above, it becomes extremely difficult to present a general picture of the circulation of air over the region. This difficulty becomes further intensified by the wide variation between corresponding months of different years. For example, at Pond Inlet during the years 1922 to 1927 the mean pressures at sea-level for December varied from 29·65″ to 30·02″ This is more than twice the variation experienced at Toronto during the same period. Two facts, however, seem to be well established. First, there is a fairly permanent anticyclone, most prominent in winter, over the region to

the west of Baffin island, which gives rise to cold northwest and north winds in Hudson strait. Second, there is a southeasterly circulation up Davis strait, which seems to be a feature of all seasons except the spring, and undoubtedly exercises a great influence in moderating the winter temperatures of the Eastern Arctic.

The existence of this latter phenomenon is confirmed by 138 pilot-balloon ascents made at Pond Inlet during September and October, 1930, and March to July, 1931. At an altitude of about 1,500 metres there is a southeasterly resultant in all the months except July. This is about the height at which the observations should be freed from the influence of the surrounding mountains. At greater heights southwest to northwest winds prevail, so that it is probable that the southeasterly current is shallow; unfortunately the ascents are too few to permit us to draw any detailed conclusions. As there was no equipment for night flights, the winter months are unrepresented.

Temperatures and the Seasons

In the north there can scarcely be said to be four seasons, in the sense in which we use the word in lower latitudes. At least eight months of the year are unequivocally winter as far as temperature is concerned, and the short summer in the far north is largely a process of warming up and then, after the end of August, again freezing. That the weather can be delightful, all summer visitors to the region know. Observers agree that the summer over the whole region is marked by clear, calm days and cool, invigorating nights; nights only in name when the sun remains above the horizon all the time. Even on Devon island on the 1st of September, the passengers on the *Nascopie* found the weather ideal for outdoor activity.

Nor are the winter temperatures as low in the Eastern Arctic as are those found in the continental region of Hudson bay. The lowest monthly mean at Bache was –33·7° F. in February, 1931; at Lake Harbour, –29·8° in February, 1922, while at Port Harrison, also in February, 1922, the mean for the month was –25·2°—the lowest on record there. The extreme minimum temperatures, too, fail to reach the degree of cold recorded in the Western Arctic. Fifty-four (54) below zero is the lowest observed at Pond Inlet, –50 at Lake Harbour, and –57 at Port Harrison. At Bache, –54 has been recorded. The reader will notice that Port Harrison, with the lowest absolute minimum, is the farthest south of the stations, being more than 20 degrees of latitude south of Bache. As suggested above, the comparatively warm current up Davis strait is probably responsible for keeping the temperatures from falling lower on the far northern coasts.

It must again be emphasized that these temperatures do not represent the temperatures on the ice and snow fields of the interior. Even so, the climate is less severe than in the Western Arctic, where the lowest temperature ever officially recorded in Canada was reached, –79° F. at Fort Good Hope on the Mackenzie river.

Surprising at first sight is the large daily range of temperature shown at the far northern stations during the polar night. The difference between the mean maximum and the mean minimum for a month is called the mean daily range, and is ordinarily due to the diurnal heating by the sun and the corresponding cooling during the hours of darkness. But at Bache in December, where the sun is not seen at all, the daily range works out as 12·5° F. A little consideration will show that a great deal of this may be spurious, for if the temperature varies at all, as it inevitably does, the maximum for a twenty-four hour period, no matter how chosen, will necessarily be higher than the minimum; consequently the mean maximum will be higher than the mean minimum, without the necessity of any really periodic change of temperature. Continuous

records of temperature for a station in the Eastern Arctic during the polar night are not available at present, so that we cannot at the moment state whether there is any real daily range of temperature.

The summers are cool. At Bache 62° has been reached, and at Dundas Harbour 63°. At Pond Inlet the absolute maximum is 77°, but this was probably due to some exceptional combination of circumstances. The highest at Lake Harbour is 74°, at Port Harrison 76°, while at Fort Chimo, which is at the south end of Ungava bay, 88° has been reported. In considering extreme temperatures, it should be borne in mind that the longer the period of the record, the greater the likelihood of an unusual extreme. However, it may generally be said that the highest temperatures to be expected will range from about 60° on Ellesmere island to about 80 or a little more on the coasts of the Ungava peninsula.

Apart from these extremes, the temperature during the months of July and August remains mostly between 30 and 50 degrees over the whole archipelago. During the 1933 voyage of the *Nascopie* it was remarkable how steady the thermometer kept. But from the middle of September on, temperatures decrease rapidly at the more northerly stations, zero having been recorded in October at Dundas Harbour, and –28° at Bache in the same month. Even at Port Harrison 2 above zero has been reached in October. The winter comes suddenly.

Just as September and October complete the change from summer to winter, so April and May, with rapidly rising temperatures, usher summer in. At Pond Inlet, for example, the mean temperature for March is 22 below zero; for May, 23 above, with a mean maximum just at freezing point and an absolute maximum of 66°. Only in June, July, and August, however, will many nights be found free from frost.

As the question of the number of days without frost is of some interest in certain biological investigations, the following table is presented:—

TABLE SHOWING MEAN AND MINIMUM NUMBER OF DAYS WITHOUT FROST IN EACH MONTH

Station	Years obs'd.	—	April	May	June	July	Aug.	Sept.	Oct.	Nov.
Bache Peninsula	3	Mean	0	0	20	29	26	11	0	0
Lake Harbour	6	Mean	1	4	17	30	30	11	2	0
		Min.	0	0	12	29	29	10	0	0
Fort Chimo	10	Mean	0·3	4·8	19·0	30·1	29·0	20·3	4·7	0·3
		Min.	0	0	0	28	25	7	0	0
Port Harrison	7	Mean	0·3	4·8	8·5	25·5	28·9	19·6	4·4	0
		Min.	0	0	1	20	25	13	0	0

It will be seen that at all of these stations, some frost may be expected during every month of the year. There is a wide variation between corresponding months of different years; for example, at Port Harrison there were 26 days without frost in June, 1924, but only one in June, 1925. The criterion for the above table is a minimum temperature in the screen greater than 32° F.; as the minima throughout the summer are chiefly in the thirties, it is probable that the grass minimum temperatures would fall to 32° on the majority of nights even in July and August. Unfortunately no grass minimum temperatures are available.

As the mean minimum temperature for April at Lake Harbour is 0·9°F., it is of interest that during this month the thermometer occasionally stays above the freezing point for an entire twenty-four hours. A careful examination of the records for these dates shows that at least one could be ascribed to a

"chinook" effect, there being a northeast gale during the night; but such an effect taking place with a southwest wind probably indicates an invasion of warm air which originated far to the southward. The pressure maps suggest a maritime (Atlantic) origin for this air.

The late Dr. Malte suggested that the existence of rather more abundant vegetation on the north shore of Hudson strait than on the south shore might possibly be explained by the spring temperatures being higher on the north side. A comparison of the monthly normals for Cape Hope's Advance on the south side with those for Lake Harbour on the north side shows that the Lake Harbour temperatures for May, June, and July are higher by 1·4, 2·8, and 2·4 degrees Fahrenheit respectively. This small difference is in support of the hypothesis, especially as a few degrees near the freezing point must make a good deal of difference to plant life; but too much reliance cannot be placed on its reality, as the standard deviation of the Cape Hope's Advance temperatures is of the same general magnitude.

PRECIPITATION, FOG, AND CLOUD

The precipitation in the Far North seems to be light. The records at Bache give a mean annual precipitation of 4·85″, of which 1·89″ falls in the form of snow. Most of the snowfall occurs in a few days in September, October, and November, while August is the rainiest and also the cloudiest month. In the depths of winter, it would appear, little snow falls, though much drifting occurs. At Dundas Harbour there is 10·17″ of precipitation of which almost half is snow. As at Bache, most of the snowfall occurs during the autumn, and August and September are rainy, with 1·82″ and 1·64″ respectively. August is the cloudiest, July the foggiest month. In July, 1931, a thunderstorm was reported from Dundas; this must be an extremely unusual event. On account of the shortness of the records, the above figures of precipitation must be taken only as indications.

At Lake Harbour the mean annual precipitation is 15·43″, an amount probably fairly representative of the southern half of the coasts of the archipelago. Of this, 11·20″ is snow, which represents a total snowfall of more than nine feet. The precipitation is fairly well distributed over the year, with a minimum in June and a maximum in November. On the average, precipitation occurs on 78 days during the year.

Data for the Ungava peninsula is scanty. Fort Chimo reports a total of 28·61″ for the year, with a maximum in July and August. Hebron, Labrador, on the other side of the Tornegat mountains, has only 19·30″ and the maximum is in September. It may be supposed that the mountains, which reach elevations of from 5,000 to 8,000 feet, precipitate much moisture out of the prevailing westerly winds. Port Harrison has 5·30 inches of rain, mostly in August and September, but trustworthy records of snowfall are not available. The difficulties of measuring snow in such a region of uneven topography can well be imagined.

In general, the data indicate that the total annual precipitation varies from less than 10″ on the coast of Ellesmere island to nearly 30″ in parts of the Ungava peninsula, with about 15″ in southern Baffin island. The season of greatest precipitation is everywhere the late summer and autumn. On account of the great variability of the climate, a very long series of records would be necessary in order to obtain a satisfactory normal for this element.

Data regarding fog are practically non-existent, and the little we have obviously fail to present a proper picture. For instance, a fog at Lake Harbour is rather a rare occurrence, according to both the records and the testimony

of residents; but Lake Harbour is well inland from the open sea, and the fog frequency at sea during all seasons is well known by Arctic navigators to be much greater than on land. During the 1933 voyage of the *Nascopie* it was a common experience to have fog and low cloud at sea when the terrain a mile or so inland was in bright sunshine. At Dundas Harbour 29 days of fog per year are recorded, but this is probably well below the annual frequency of fog at sea in this latitude. October, November, and December are the only months entirely free from fog at Dundas.

In the northern portion of the archipelago, the winter is distinguished by clear skies, while the summers are more cloudy. This is just the reverse of what occurs, for example, at Toronto, and is explained by the total absence of convection during the polar night. During March, 1933, at Bache, the mean cloudiness reached the exceedingly low figure of 8 per cent, on the basis of three observations daily. (The mean cloudiness in March for three years' observations is 25 per cent.) At Bache and Dundas, the mean cloudiness for the months December to April inclusive is 29 per cent and 34 per cent while that for the remaining months is 57 per cent and 58 per cent respectively. At Dundas, August, 1931, had a cloudiness of 82 per cent, the greatest observed at that place.

The winter minimum of cloudiness, though still present, is much less marked in Hudson strait. At Nottingham island the mean cloudiness for January, the clearest month, is 40 per cent, February and March following with 45 per cent and 46 per cent respectively. The summer and autumn are distinctly cloudy, October being the cloudiest month with a mean of 85 per cent, though May runs it close with 83 per cent, and one May (1932) showed 93 per cent. Reliable cloud observations are not available for the Ungava peninsula, but it is probable that the Hudson Bay side will show much the same distribution as Nottingham island.

The cloud forms in the Arctic in summer are very interesting. During the voyage of the *Nascopie* a large number of rather special forms of alto-cumulus were observed, often showing periodic structures of great regularity. One of the most interesting had the form of a series of equally-spaced veils, quite diaphanous and apparently hanging vertically from little puffs of cloud; an attempt to photograph this beautiful phenomenon was unfortunately unsuccessful. Long, uniform rolls of stratus or strato-cumulus occurred on several occasions. On one such occasion in Hudson bay, the temperature, as measured by an Assmann psychrometer, rose about 0·5° C. as the ship passed under each roll, and then fell again, the relative humidity at the same time falling from 94 per cent to 85 per cent and then again rising. The bottoms of the rolls were very low, say 150 feet, and the distance between rolls was about half a mile. It is difficult to escape the impression that these were huge eddies with horizontal axes.

Unfortunately we have no data on the mean height of the base of the clouds in the Eastern Arctic, or the frequency of various heights. This element is of great importance to aviation. If the summer of 1933 was in any way typical, the impression may be recorded that low cloud is distinctly prevalent, at least over the sea and the coasts, during the season of navigation.

THE WEATHER OF THE EASTERN ARCTIC

By most of the dwellers in more temperate regions, the Arctic is considered a desert, inhospitable land in which no man who had freedom of action would live. Contradicting this impression is the undoubted fact that many traders and officials who have spent a few years in the region prefer it to any other, and could not be induced to live elsewhere. It is probable that the weather is not the least of the reasons for this predilection.

It may at once be admitted that the Arctic winter is cold, but the polar night is characterized by clear skies, when the moon, stars, and aurora borealis shine out in all their brilliance, and travellers and residents agree that enough light is usually available for necessary outdoor occupations.

Occasional blizzards occur throughout the winter, but for the most part the winds are light, calms being most frequent during the most intense cold. When the sun first begins to come above the horizon, a period of "cold daylight" ensues. Gradually the increasing altitude of the sun raises the temperature, and then with remarkable suddenness winter changes to spring, the snow melts from exposed locations, and in a few weeks the brilliant Arctic flora covers the valleys.

The summer in the Arctic is a delightful season, cool and for the most part bright, with only enough rainy days to vary the monotony. During July and August there are few storms or strong winds, and small boats are sailed long distances around the coasts.

With the coming of September, the temperatures rapidly fall. Storms become more frequent. Fewer clear days occur, and the ice begins to reform in the bays. October is definitely the beginning of winter, the heaviest snowfall of the year occurring either in this month or the next. The winds at this season are stronger than at any other time of the year, and the calms fewer. The sun drops lower, finally disappearing on October 22 in latitude 80°, on November 6 in latitude 75°. The winter sets in, the temperatures continuing to fall until late in January or in February. The weather becomes calmer and clearer, offsetting to some degree the greater cold.

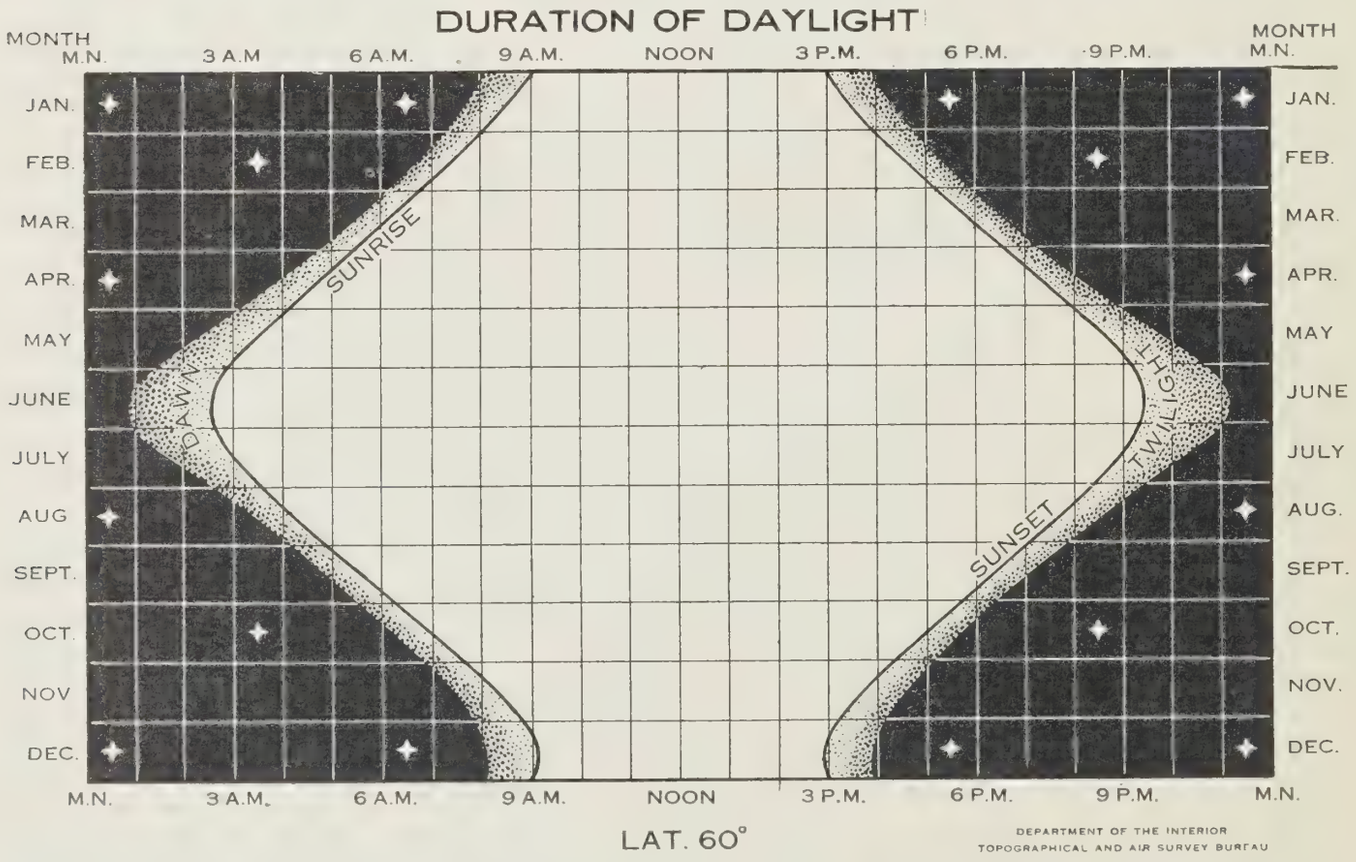

Chart Showing the Duration of Daylight at Latitude 60° N.

GOVERNMENT AND ADMINISTRATION

It has already been explained in the section entitled "Acquisition of the Northwest Territories by Canada," that the present form of government of the Northwest Territories by a Commissioner and Council was established by Act of Parliament, after the creation of the provinces of Alberta and Saskatchewan in 1905. The first Commissioner was Lt.-Col. Fred White, who was also Comptroller of the Royal Northwest Mounted Police. Colonel White was succeeded in 1920 by W. W. Cory, C.M.G., then Deputy Minister of the Interior. Mr. Cory was succeeded in 1931 by H. H. Rowatt, C.M.G., also Deputy Minister of the Interior.

NORTHWEST TERRITORIES COUNCIL

The membership of the Northwest Territories Council is fixed at not more than six by the same Federal legislation which provides for the government of the Territories, i.e. the Northwest Territories Act, Chap. 142, R.S. 1927. The Council is at present composed of:—

Deputy Commissioner: R. A. Gibson, Assistant Deputy Minister of the Interior.

Councillors: Dr. Charles Camsell, Deputy Minister of Mines; A. L. Cumming, Chief Mining Inspector, Department of the Interior; K. R. Daly, Solicitor, Department of the Interior; Major-General J. H. MacBrien, Commissioner, Royal Canadian Mounted Police; Dr. Harold W. McGill, Deputy Superintendent General of Indian Affairs.

Secretary: D. L. McKeand, Lands, Northwest Territories and Yukon Branch, Department of the Interior.

It will be observed that the Council is composed of representatives of the Department of the Interior, the Department of Mines, the Royal Canadian Mounted Police, and the Department of Indian Affairs, all of whom have an official interest in the Territories outside their connection with the Northwest Territories Council. All members serve without extra remuneration.

Responsibilities of Council

The Northwest Territories Act provides that the Northwest Territories Council shall have the same power to make ordinances for the government of the Territories as were on August 31, 1905, vested in the Legislative Assembly of the Territories, in relation to such subjects then within the legislative authority of the Assembly as are from time to time designated by the Governor General in Council. The Act goes on to specify, without restricting, certain classes of subjects which may be so designated, such as: education; the solemnization of marriage; property and civil rights; the issue of licences to explorers or scientists to enter the Territories to carry out certain investigations; the levying of taxes on furs shipped out of the Territories; etc. The Act also stipulates that the Commissioner in Council shall not have greater powers than are given to provincial legislatures under the British North America Act, 1867, and, that all ordinances made by the Commissioner in Council shall be laid on the tables of both Houses of Parliament as soon as possible.

Council also advises the Minister of the Interior on matters pertaining to the administration of the Northwest Game Act, and the various ordinances which have been passed from time to time.

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LAWS AND REGULATIONS

Since the area designated the Eastern Arctic lies within the Northwest Territories, the laws applicable to it are those of the said Territories. Subject to the provisions of the Northwest Territories Act, the laws of England relating to civil and criminal matters as they existed on the fifteenth day of July, 1870, the date on which Canada took over the administration of the Territories from the Hudson's Bay Company, are in force in the Territories in so far as they are applicable or have not been repealed or modified by an Act of the Parliament of Great Britain or of the Parliament of Canada; and every Act of the Parliament of Canada, except as otherwise provided, is in force in the Territories in so far as it is applicable. The more local legislation is enacted by Orders of the Governor General in Council and Ordinances of the Northwest Territories Council.

In addition to subjects previously mentioned, the legislative powers of the Commissioner in Council are extended to such matters as the constitution, organization, and maintenance of Territorial courts of civil jurisdiction, the imposition of punishment by fine, imprisonment, or other penalty for enforcing Territorial Ordinances, and generally all matters of a local or private nature in the Territories. Provision is made in the Northwest Territories Act for the appointment by the Governor General in Council of stipendiary magistrates. The stipendiary magistrates may, in a summary way, try such charges as minor thefts, unlawful wounding, and certain types of assault. Other charges are tried with the intervention of a jury of six unless the accused elects to be tried by the stipendiary magistrate in a summary way. The Governor General in Council may also appoint Justices of the Peace having the jurisdiction and powers of authority of two Justices of the Peace, which generally speaking, gives such an appointee the authority of a magistrate.

So far the development of the districts has not warranted the establishment of permanent courts. All Commissioned Officers of the Royal Canadian Mounted Police are Justices of the Peace for the Northwest Territories with the powers of two Justices of the Peace. A Commissioned Officer usually accompanies the annual Eastern Arctic Expedition, and the Officer in Charge of that Expedition is also vested with similar authority. In addition, should special occasion necessitate, a stipendiary magistrate may be sent in with the Expedition, as was done some years ago.

Ordinance Respecting Scientists and Explorers

Under this Ordinance those who desire to enter the Northwest Territories for scientific or exploration purposes must first secure a licence so to do from the Commissioner. Evidence must first be furnished to the satisfaction of the Commissioner that the expedition is not being conducted for commercial purposes and is adequately equipped and financed.

Eskimo Ruins Ordinance

Permits may be issued under this Ordinance to scientists and explorers of recognized standing to excavate or investigate Eskimo ruins and to remove specimens of ethnological or archæological importance when the Commissioner is satisfied that it is in the interest of science to grant such permits.

Northwest Game Act and Regulations

This Act, and the Regulations passed thereunder, provide for the conservation and preservation of game for the benefit of the native population and other residents.

Trading and Trafficking in Game.—The regulations provide for the issue of permits to establish trading posts at locations approved by the Department of the Interior, and for the issue of licences to those persons who are to conduct the trading operations. The fees in the latter case vary according to whether the licensee is a resident of the Territories, a non-resident British subject, or a non-British subject. The definition of "resident" in these regulations is,—"Any British subject who has resided in the Northwest Territories for a period of four years not necessarily continuously or who has carried on the business of trading and trafficking in game in the Northwest Territories for a period of four years". Trading permits are issued only when it is considered in the interest of the native or other residents to do so.

Hunting and Trapping.—With a view to conserving the game supply principally for the native population who depend on it entirely for their livelihood, the current regulations were drafted to provide that hunting and trapping licences may be issued only to residents and those non-residents who held such licences on June 30, 1932. Native-born Indians, Eskimos, and half-breeds do not require licences to hunt and trap.

Game Preserves.—Under authority of the Northwest Game Act, game preserves have been created in which only native-born Indians, Eskimos, or half-breeds may hunt or trap. Bona fide prospectors are permitted to enter these preserves for the purpose of prospecting for minerals. The Arctic Islands preserve covers a considerable portion of the Eastern Arctic. Its boundaries are marked on the official 60-mile-to-1-inch map of the Northwest Territories. The native game preserves ensure continuance of the game supply for the natives.

Musk-ox.—With a view to conserving musk-ox, which were fast disappearing, the regulations provide that these animals shall not be killed by anyone. From recent reports received by the department it would seem that this animal is increasing in numbers in the outlying Arctic islands, and it is hoped that before very long it will again be of considerable economic importance in the Canadian Arctic.

Miscellaneous.—The Game Regulations fix close seasons; provide for the issue of licences to carry on fur-farming; provide for the taking of game animals for propagation purposes; prohibit the use of poison for the killing of game; provide for the issue of licences to take specimens of game for scientific purposes, and so on.

Fur Export Ordinance

Under this ordinance no furs may be exported without a permit and certain fixed taxes or royalties must be paid on the pelts exported. The taxes are closely in line with those of the provinces adjoining, and are usually collected by members of the Royal Canadian Mounted Police who are game officers for the Territories.

MINING REGULATIONS

No intensive prospecting has been carried on in the Eastern Arctic but minerals of economic value have been discovered at various points. There are a number of mining regulations applicable to the Northwest Territories but the following are the principal features of the two most important, namely, the Quartz and Coal Mining Regulations.

Regulations for the Disposal of Quartz Mining Claims

Every person eighteen years of age and over, but not under, and every mining partnership, and every joint stock company may obtain a miner's licence on payment of the prescribed fee. Licences expire on March 31 following the

date of issue, and no person (except as a shareholder), mining partnership or company, not the holder of a miner's licence, is permitted to acquire any interest in a mineral claim.

The fee for a miner's licence for an individual is five dollars; for companies it varies according to the amount of capital.

Miner's licences may be obtained from the mining recorders at Fort Smith and Cameron Bay, Northwest Territories, from any sub-mining recorder in the Territories, and at Edmonton, or from the Department of the Interior at Ottawa. Licences to companies are issued only by the Minister or by the Deputy Minister.

A licensee may stake six claims in his own name and six claims each for not more than two other licensees, or eighteen claims in all, in any licence year, in any one mining division. A claim includes a plot of ground 1,500 feet in length by 1,500 feet in breadth, with boundary lines running north and south and east and west as nearly as possible, and must be marked on the ground with four legal posts, number one post to be placed on the northeast corner, number two at the southeast corner, number three at the southwest corner, and number four at the northwest corner. A location not exceeding 160 acres may be granted for the mining of iron and mica.

Application for a grant of a claim must be made to the mining recorder for the district within fifteen days after staking if the claim is located within ten miles of recorder's office, an extra day being allowed for each additional ten miles or fraction thereof.

The fee for recording each claim located by a licensee on his own licence is Five Dollars, while the fee for recording each claim located by a licensee on behalf of another licensee is Ten Dollars.

A grant issued in connection with a claim entitles the grantee to hold such claim for a period of one year, and thence from year to year without the necessity of re-recording, provided that development work to the value of One Hundred Dollars is performed on the claim each year.

Claims not exceeding thirty-six in number may be grouped for representation purposes, the holders of the claims so grouped being permitted to perform on any one or more of such claims all the work required to entitle the holders to certificates of work for each claim.

When the holder of a claim has done or caused to be done work on the claim itself to the value of Five Hundred Dollars and complied with certain other requirements, he may obtain a certificate of improvements.

The holder of a mineral claim for which a certificate of improvements has been granted and recorded is entitled to a twenty-one year lease of such claim upon payment being made within three months of the prescribed rental and fee.

The rental of a whole or fractional mineral claim, granted under lease, is Fifty Dollars, provided the claim does not exceed the maximum area of 51·65 acres. For each acre in excess of the said maximum area which the claim may, upon survey, be shown to contain, and which may be included in the lease, payment must be made of rental at the rate of Five Dollars an acre. The rental is payable in advance within three months after the date upon which a certificate of improvements in connection with the claim may be issued, and no further rental is due or payable in connection with a claim until the termination of the period of twenty-one years. For the renewal of a lease, the lessee must pay in advance the sum of Two Hundred Dollars, to cover the rental for a further period of twenty-one years, and for excess area at the rate of Twenty Dollars an acre. The rental of an iron or mica claim containing an area of 160 acres is One Hundred and Fifty Dollars for the first period of twenty-one years, and Six Hundred Dollars for a renewal for a similar period. If the claim contains more than 160 acres, payment must be made for the excess area at the

rate of Five Dollars an acre, for the first period of twenty-one years, and at the rate of Twenty Dollars an acre for the second period. The fee for the issue of a lease of a mineral claim is Ten Dollars.

Coal Mining Regulations

Under these regulations, which apply to the Northwest Territories and Yukon, coal mining rights may be leased at the rate of One Dollar an acre for a period of twenty-one years, subject to renewal.

The maximum area of a coal mining location shall be 2,560 acres, and no person shall be permitted to acquire more than one location, except by assignment.

Application for a location in unsurveyed territory shall be filed by the locator in person with the mining recorder for the district within thirty days after staking, but if the location is situated more than one hundred miles from the mining recorder's office, one additional day shall be allowed for each ten miles, or fraction thereof, in excess of one hundred miles.

Each application must contain a description of the location by metes and bounds and be accompanied by a plan showing the position of such location, also a fee of Five Dollars. The location must be defined on the ground by two wooden posts and shall be rectangular in form, the length not to exceed four times the breadth.

A royalty at the rate of Five Cents per ton of two thousand pounds is payable on the merchantable output of a mine.

In isolated portions of the Northwest Territories, Indians or Eskimos who apply for permission to mine small quantities of coal for their own use, or for sale to others in their locality, may be granted permission so to do by the local sub-mining recorder, or other authorized officer, free of charge, without being required to make application under the provisions of the regulations.

The provisions of these and other regulations are subject to change, and up-to-date information should be obtained from the Lands, Northwest Territories and Yukon Branch of the Department of the Interior, Ottawa, before prospecting or other mining operations are commenced in the Northwest Territories.

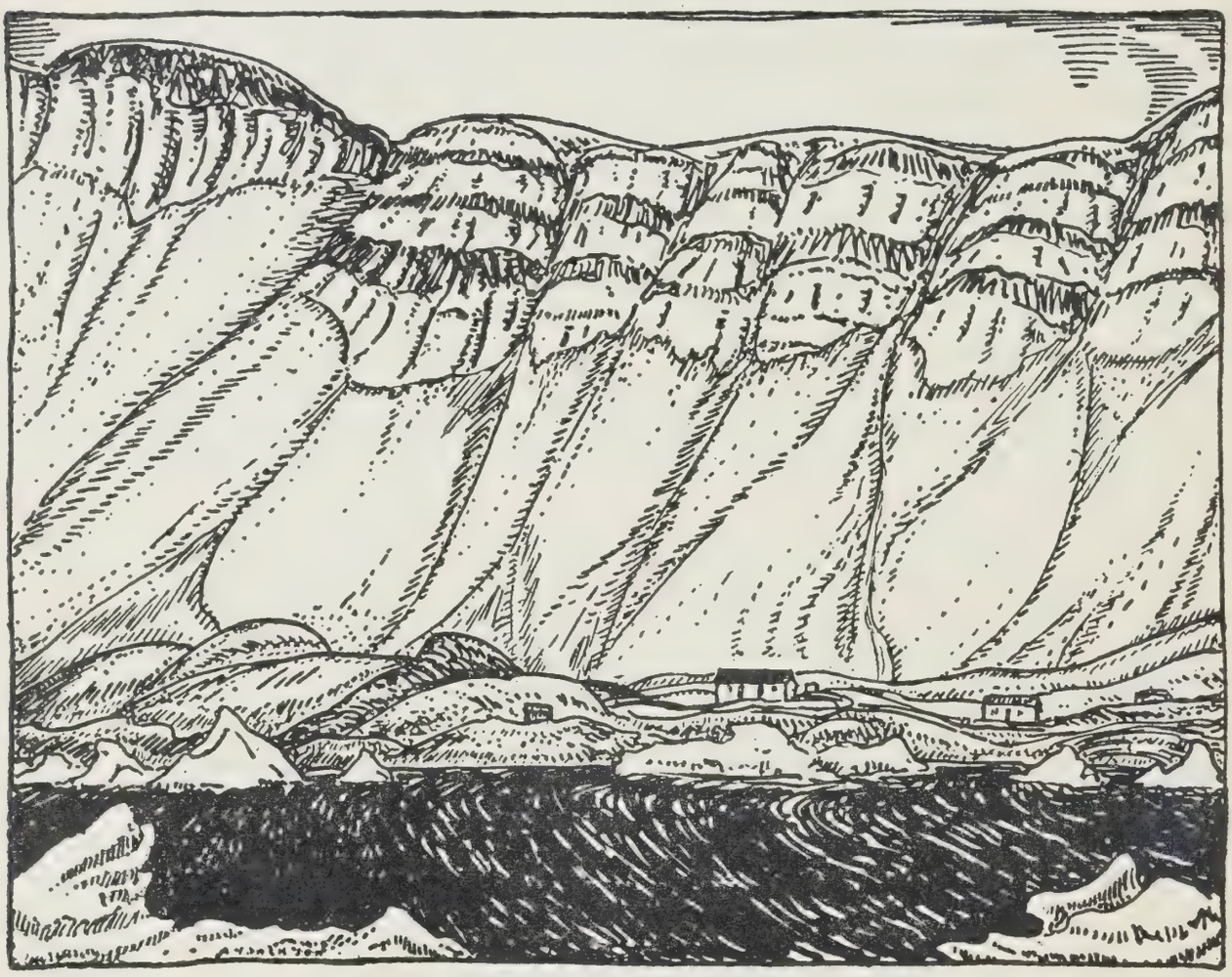
ROYAL CANADIAN MOUNTED POLICE

As in the early days on our western plains when the Royal Canadian Mounted Police represented Law and Order and kept the peace under most difficult conditions in a way which gained for them general admiration, so in the North, in both the Western and Eastern Arctic, under totally different and in many ways even more onerous conditions, the traditions of the Force have been fully maintained. Not only have the Police the respect and admiration of the natives but they have their implicit trust and regard. The natives know the Police are their friends and consequently the task of applying in the region the elementary laws and usages of civilization has been made possible.

In many districts the Royal Canadian Mounted Police are the only Government representatives and consequently upon them devolve the duties of a general agent for all departments which require varied functions to be performed at the points where they are stationed. Upon occasion members of the Force carry on postal, customs, and other related work and upon them is placed the responsibility for the distribution of relief where there is no medical officer.

The very large areas under the jurisdiction of each detachment necessitate long and arduous patrols by sledge and motor boat, and thousands of miles are covered each year by these methods. The purpose of the patrols in Eskimo territory is to investigate reports of crime, to enforce the Ordinances of the

Territories, to ascertain and report on the health and general welfare of the natives, the prevalence or scarcity of game, to look after cases of destitution, to secure vital statistics, and to meet, so far as the Police can, any emergency situation that may arise. The fact that they are usually isolated from headquarters for about a year at a time frequently calls for the exercise of independent judgment and initiative.



BACHE PENINSULA POST

Canada's Farthest North Government post. Reproduced from a book of drawings entitled "The Far North," published by Mr. A. Y. Jackson of Toronto. Mr. Jackson accompanied the Eastern Arctic Expeditions of 1927 and 1930.

During the past year the Port Burwell detachment patrolled by dog sledge the whole of the Ungava Bay coast as far as cape Hopes Advance. The same area was again patrolled by boat during the summer. Ten patrols were made from Lake Harbour by motor boat and dog sledge, the whole of the southern Baffin Island coast from cape Dorchester to Frobisher bay being covered at least twice. The Pangnirtung detachment visited the native camps in Cumberland sound and on the east coast of Baffin island as far north as Kivitoo. The Pond Inlet detachment patroled the rest of the east coast, and in addition made a sledge journey to Foxe basin by way of Milne inlet. This patrol visited Melville peninsula and returned by way of Gifford river, Admiralty inlet, and Arctic bay. The 1933 patrols from Dundas Harbour on Devon island and Craig Harbour on Ellesmere island were largely connected with the transfer of the Bache Peninsula detachment to Craig Harbour.

Due to the fact that the 1932 Eastern Arctic Expedition could not reach Bache Peninsula, two long and difficult patrols made from Bache in 1932 in

search of the lost German Arctic Expedition directed by Dr. H. K. E. Krueger could not be reported until last summer. The search party, which included Smith Sound Eskimos from Greenland specially employed for the purpose, crossed Ellesmere island by way of Flagler bay and Bay fiord. Here the party divided. The corporal in charge turned north and completely circled Axel Heiberg island searching the irregular coastline for traces of the lost explorer. The constable travelled south and west to Cornwall island. In a cairn on north-western Axel Heiberg island a note signed by Krueger was found, which translated read:—

> "The German Arctic Expedition reached this Stoneman on the 24th April, 1930, and found the attached copy of statement from Peary and MacMillan. We come from Lands Lokk and are going on towards Meighen island."

Unfortunately due to very rough ice between Axel Heiberg island and Meighen island, and the shortage of dog feed Meighen island could not be reached, but the party continued south along the west coast of Axel Heiberg in the hope that Krueger might have gone in that direction or returned. A large number of the dogs died during the patrols, but all of the men got back to their base safely.

The following paragraph taken from the report of the corporal in charge will indicate some of the difficulties met and overcome: "For the next 48 hours it was a case of packing and relaying, climbing up and down over very rough ground for about four miles. The descent to the river ice leading to Bay fiord was about three-quarters of a mile and a dangerous grade. This took us about twelve hours. The natives showed their skill in letting the loaded sleighs down. This was accomplished by joining the strongest harpoon lines together and letting each sleigh down singly attached to the line with one man to guide it, whilst all hands paid out the line and prevented the sleigh (and the man) from getting out of control, for a distance of about 200 yards, when all the sleighs were blocked at this level. The process was repeated twice before the bottom was reached. I think we each wore out a pair of mitts at this job. This was very strenuous work and necessitated a lot of climbing up and down on all fours. When the last sleigh reached the bottom safely there was a general cheer. It is at this sort of work that the natives work slow but sure and are always happy. We had worked for two days continuously with an occasional rest and lunch. During the crossing the weather had been unusually mild, and consequently our clothing had become saturated with perspiration, which proved to be very uncomfortable when the weather turned extremely cold a few days later."

(The routes followed by the patrols mentioned above are shown on the map inserted at the back of this report).

1933 EASTERN ARCTIC EXPEDITION

As the report of the 1933 Expedition has not been published and may not be issued in narrative form, a brief outline here of the work undertaken and the territory covered, may serve to indicate in a general way the nature of this annual patrol of inspection, investigation, and administration.

As the duties planned by the departments concerned for their representatives on the Government party could be performed satisfactorily and more economically by utilizing the transportation facilities of the Hudson's Bay Company, a contract was entered into for the second consecutive year with the Company for the transportation of personnel and freight. The ss. *Nascopie,* which was specially designed and constructed for operation in the Arctic, was used and amply lived up to her reputation, providing adequate service, and sufficient accommodation.

The Government party consisted of Major D. L. McKeand, M.C., officer in charge of the expedition and representative of the Government of Canada in the northern archipelago, his assistant, and medical officers, all representing the Department of the Interior, a botanist and a geologist from the Department of Mines; a meteorologist from the Department of Marine; a parasitologist from Macdonald Agricultural College, P.Q.; and an inspector, non-commissioned officers, and constables, from the Royal Canadian Mounted Police. A representative of the Press was attached to the party as secretary and historian.

The administrative and medical officers of the Department of the Interior were concerned primarily with the condition of the natives as regards health, abundance or scarcity of food, clothing, fuel, education, hospitalization, and so forth. They reported the past as being a poor fur year, and this, together with the prevailing low price of furs, necessitated assistance being afforded many of the Eskimos during the winter months. Fortunately seals, on which these people depend so largely for food, fuel, and to some extent for clothing, were reasonably plentiful in most districts. The medical officer at Pangnirtung, Baffin island, was relieved after two years' service, and he together with the relieving officer examined and treated the sick whenever the opportunity presented itself. Generally speaking, the natives were found to be healthy and happy.

The "Nascopie" Working Through Loose Ice, 1933

In addition to investigations in the immediate vicinity of each port of call, the geological work accomplished included an examination of ore deposits near cape Smith in northeastern Hudson bay, which a mining corporation had been prospecting for the past two or three years. This examination necessitated a stop-over on the part of the geologist and the Mounted Police constable detailed to accompany him. They were picked up later by the expedition at cape Wolstenholme.

Due to the sudden illness and lamented death of the botanist, Dr. M. O. Malte, botanical investigations were cut short at the end of the first

leg of the voyage. It had been hoped that this year Dr. Malte's already extensive collection of Arctic plants would have been rounded out, and thus enabled the publication of a comprehensive report on Canadian Arctic flora.

The representative of the Department of Marine carried out meteorological observations, inspected meteorological stations at the posts visited, installed three new stations, and instructed those left in charge of the recording equipment.

The parasitologist, who accompanied the expedition as far as Charlton island, inaugurated a survey of intestinal and other parasites carried by game and domestic animals in the Northwest Territories. A considerable quantity of material was secured for laboratory examination, and containers and preservative were left at strategic points to be picked up later in the season, or during 1934. The results so far reported have been most gratifying and promising.

The officer in charge of the Royal Canadian Mounted Police party inspected all detachments, and carried out the changes in personnel as planned.

The expedition sailed from Montreal on July 8, 1933, and made calls at Cartwright, Labrador; Port Burwell; Lake Harbour; Wakeham Bay; Sugluk; Cape Wolstenholme; Cape Smith; Port Harrison; Charlton island in James bay; Churchill; Southampton island; Cape Dorset; Craig Harbour; Robertson Bay, Greenland; Pond Inlet; River Clyde; and Pangnirtung; docking at St. John's, Newfoundland, on September 27.

A distance of 12,000 miles was covered by the members of the party. Ice conditions while troublesome during the early stages did not cause undue delay, although undoubtedly that would have been the case had not the vessel been specially strengthened and powered for work in the ice.

POPULATION

The population of the Eastern Arctic is predominantly Eskimo. There are white people—missionaries, traders, and Government officials, the latter including members of the Royal Canadian Mounted Police—but they are very much in the minority. Few white women reside in the district. In addition to the whites and Eskimos, a small portion of the population is of mixed blood. Some Indians live in the vicinity of Chimo on the Koksoak river, which is approximately the northern limit of the tree-line in Quebec.

The reader of books on travel and exploration in Arctic regions is quite likely to form the impression that the Eskimo population of Canada is much smaller now than it was when Europeans first visited the Canadian Arctic. This seems to be generally accepted as correct by those who have given the matter serious thought, but it is quite possible that the extent of the change is frequently over-estimated. It may be taken for granted that the introduction by white men of new diseases, new food and clothing, and the disturbance of established customs has had a harmful effect. It should be remembered that the Eskimos are nomadic, and are influenced in their movements from place to place by the prevalence or scarcity of game. The fact that Eskimos and Indians are never very friendly to one another seems to have had an effect upon the migrations of both, and, of course, the Indians were equipped with firearms long before the Eskimos. This may have resulted in the driving of the Eskimos north from the southernmost portion of the areas they formerly occupied.

These movements from place to place, and concentrations in certain areas, make it extremely difficult to obtain a picture of the whole, and it was not until 1927 that a reasonably complete census of the Canadian Eskimos was taken. Vital statistics for the Franklin District for the five years 1927-31 inclusive show a substantially greater number of births than deaths, but again it must be kept in mind that this difference might be wiped out by a serious epidemic. The vital statistics will be of much greater value when they cover a reasonably long period.

Eastern Arctic Eskimos do not now live north of Lancaster sound, except where employed by the Royal Canadian Mounted Police at more northerly posts. A census of the Eskimo population can only be approximately accurate, although a special effort was made during the 1931 census to make it as complete as possible. It is compiled from returns submitted by the Royal Canadian Mounted Police, medical officers, traders, and missionaries. The number and distribution of whites and Eskimos in the Eastern Arctic, according to the 1931 census was as follows:—

Baffin Island—	Whites	Eskimos
South coast, Foxe peninsula to Frobisher bay	23	790
East coast, Cumberland sound to Coutts inlet	14	541
North, west, and south coasts from Pond inlet to Foxe basin	12	266
Ellesmere Island	2	8
Melville peninsula, including Repulse bay	4	234
Southampton island	7	143
Coats, Mansel, Belcher, and other islands in Hudson bay	10	422
Somerset island		24
Devon island	3	8
Total	75	2,436

The Eskimo population of the province of Quebec is estimated to be between 1,700 and 1,800.

ESKIMOS OF THE EASTERN ARCTIC

"The origin of the Eskimos remains a mystery, despite the intensive researches of the last fifty years. We are reasonably sure that the natives who to-day frequent the shores of the Eastern Arctic once dwelt on the Northern Plains west of Hudson bay, and did not move out to the coast until about the fourteenth century A.D. From Newfoundland north to Ellesmere island, however, we have found the remains of an earlier and in some ways more primitive Eskimo group, while still a third branch of the race has left the ruins of its habitations from north Alaska clear across Arctic America to Hudson strait and Greenland. Preceding both these prehistoric groups, yet not directly ancestral to either of them, was a group that flourished around the Bering sea in the early centuries of the Christian era, when it attained a level of culture unsurpassed and perhaps unequalled by any of its successors. Further than this we cannot yet penetrate. Several writers, observing the resemblances between certain bone and stone implements used by the Eskimos, and some implements left by "Magdalenian" man in France and other countries, believe that the Eskimos are the direct descendants of a Late Palæolithic people who once inhabited parts of Europe; but so far we have found no remains that would bridge the gap of 7,000 or 10,000 years between that period and our own, nor any traces of a migration across Siberia to the American Arctic. Quite recently, too, we have learned that the Eskimos are not an unmixed race, but that only certain groups are physically peculiar, whereas others are hardly distinguishable from the Chipewyan Indians of lakes Athabaska and Great Slave, and closely resemble also the Cree and other Indians who roamed over Eastern Canada before the coming of the white man. So, as often, a problem that once seemed simple turns out to be very complex; and no scientist familiar with its complexity would feel surprised if the same strain of blood as flows in European veins should prove to be present, albeit in a strongly diluted form, among the aborigines of our far north." D. J.*

The bridge between Eskimos of the discovery period and Eskimos of to-day is so short in the matter of years, even in the Eastern Arctic where contact was first established with Europeans, that by using one's imagination a fairly accurate picture of the primitive Eskimos can still be built up.

A few short years ago all the wants, or rather needs, of these people were met by the resources available locally. Seal, walrus, caribou, fish, birds and their eggs, berries, and roots supplied their food. Their clothing was made of pelts of seal, caribou and other fur-bearing animals, and skins of birds. Their hunting implements were made of bone, ivory from the walrus or narwhal, horn, and whatever wood they could pick up; their seal-oil lamps and cooking pots were fashioned from soapstone or other easily worked stone; the open travelling boat, and the one-man hunting boat were constructed of wood and sealskin. Dog harness, traces, harpoon lines and floats were made out of sealskin. Winter fuel was obtained from the seal or walrus. In summer moss was frequently used as fuel. Cycles of abundance and scarcity undoubtedly occurred then as now, and this, together with the natural sternness of the treeless Arctic littoral where they made their homes, would have a tendency to weed out the weak or unfit leaving a healthy and hardy people.

Between the Indians and Eskimos there was a very definite "No Man's Land." Each feared and distrusted the other and to a modified extent that distrust exists even to-day. There are places such as Fort Chimo in Ungava bay and around Fort George in James bay where they associate with and tolerate one another even though friendly relationships are not established.

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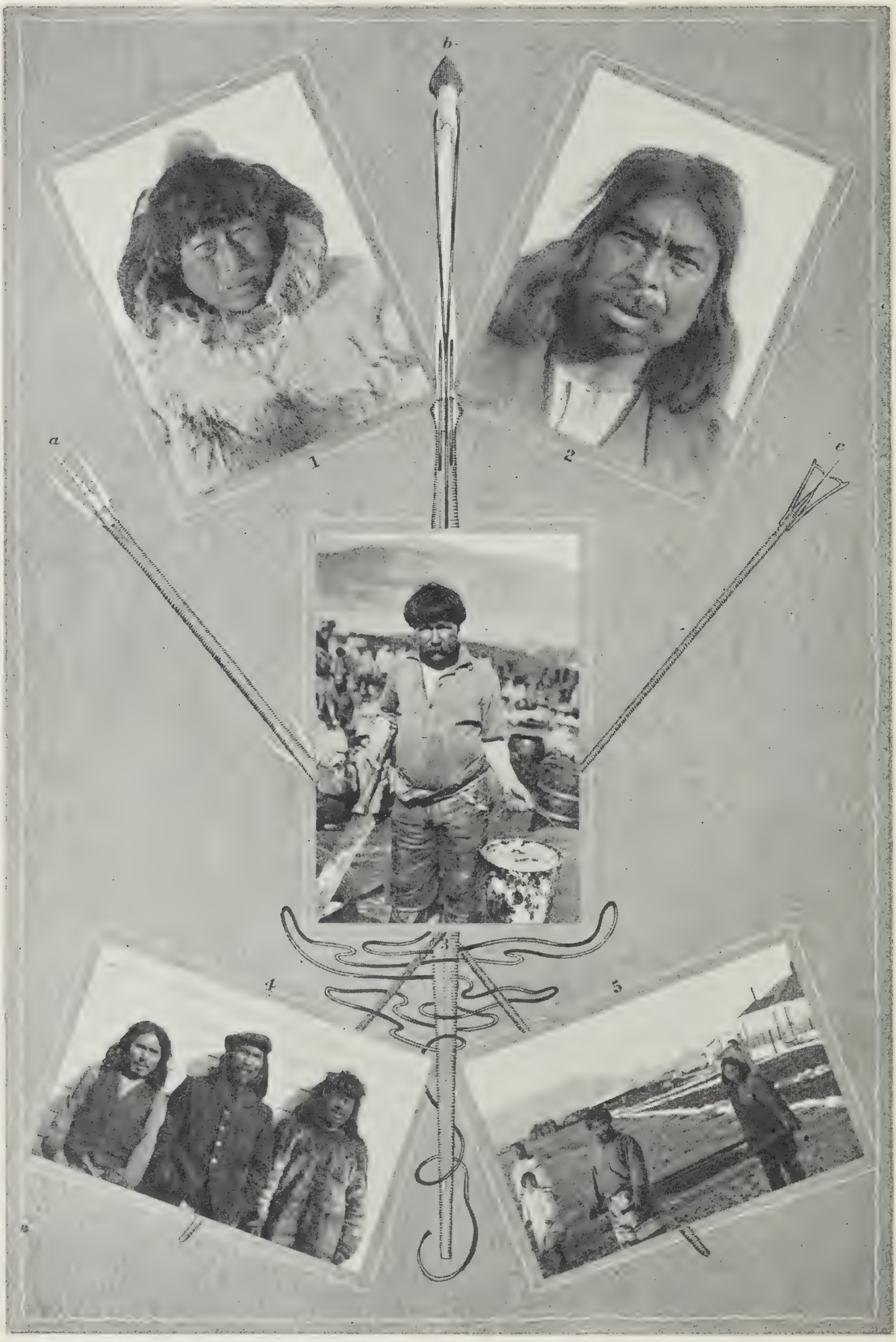
* D. Jenness, M.A. (Oxon.), F.R.S.C.; National Museum of Canada, Ottawa.



NATIVES AND NATIVE WEAPONS

1 to 5. Eskimo men of the Eastern Arctic. Sketches illustrate (a) Bird Dart, (b) Walrus or Seal Harpoon and (c) Fish Spear.

The first contacts between the Eskimos and the early explorers were not always happy. In 1576 Frobisher attempted to establish friendly relationship with the people of southern Baffin island. Five of his men were taken prisoners and never heard of again. In 1611 the mutinous crew of the *Discovery,* after abandoning Hudson, together with some of the loyal and sick members of his crew, dropped anchor at cape Digges hoping to obtain food. Five of the mutineers went ashore unarmed, were attacked and either killed outright or mortally wounded by a party of Eskimos. The same thing happened on other occasions in the Eastern and Western Arctic. In justice to the Eskimos it should be borne in mind that at this time they had no reason to believe that the visitors could be trusted. Also the early fur-traders supplied guns to the Cree and Chipewyan Indians who then attacked the Eskimos. The Chipewyans thus drove the Eskimos northward from the vicinity of Churchill towards Chesterfield inlet; the Cree drove them from the Eastmain river to the Great Whale river. This was repeated at the south end of the Labrador coast. In addition these visitors—Frobisher, Hudson, and others—came displaying an abundance, abundance at least to the Eskimos, of those worldy goods most prized by the Eskimos, wood, arms, and metal. Wood was particularly hard to obtain. It took a great many small pieces tied together with thong to make the frame-work of one of their boats, supports for their tents or material for sledges. Metal was much superior to bone or flint for the points of their hunting implements. It is not to be wondered at therefore that they may have coveted the belongings of these strangers.

Gradually the Eskimos came to realize that white men could be trusted and the white men reached a better understanding of the Eskimos. By the 19th Century, explorers found it to their advantage to make use of the services and experience of these people, and during that century when the whaling industry was in full swing in Baffin bay and Davis strait, large numbers of Eskimos were employed at the whaling stations. To-day one may travel amongst the Eskimos of the Eastern Arctic and meet nothing but friendly glances and smiles, and may leave his equipment unguarded knowing it will not be tampered with.

The coming of the white man has had both a beneficial and a harmful effect, and opinions differ as to which outbalances the other. Although basically the same the Eskimo's diet has undergone a considerable change, and the consensus of opinion of medical officers who have worked in the north seems to be that the results have not been beneficial. A taste for flour, ship's biscuit, tea, sweets, and tobacco has been developed and inability to obtain these goods is frequently considered a hardship. The only way in which these articles can be obtained is through trading in white fox skins. Obviously an Eskimo cannot be trapping foxes and at the same time hunting seals—at least not to more than a limited extent—with the result that trade goods make up the deficiency in seal meat. The modern rifle has largely replaced the bow and arrow and to some extent the harpoon. It would be difficult for these people to revert to the use of their old weapons, not only because the use of the rifle has made game more wary, but because the people themselves have lost to a considerable degree their old skill. Cotton and woollen clothing are used and while satisfactory for summer they are not adapted to winter travel, although in some localities the shortage of caribou makes some such substitute essential. The old "oomiak" has disappeared and is now replaced by imported boats made of wood which are probably much better, although not so easily portaged. The "kayak" is still used for local hunting but even it is replaced to some extent by the open canoe which has the advantage of being capable of carrying freight or extra passengers. The sealskin tent has been replaced by the canvas tent, although the former is still used by those who cannot afford to buy the imported article or the necessary material.

In addition to the importation of manufactured goods the white man introduced infectious diseases new to the Eskimos, and against which they had not built up a resistance. Although still healthy and sound organically these people are seriously susceptible to ailments which ordinarily cause white people only minor discomfort. Epidemics break out with disastrous results. One such outbreak carried off all the earlier inhabitants of Southampton island who were the remnants of a people who occupied Eskimo territory before the arrival of the present race. This condition is being met as far as possible by the Medical Service now provided. Infanticide, and the abandoning of aged or otherwise helpless relatives who could not make an enforced trip is seldom if ever heard of now. Due to the establishment of Government posts and trading posts throughout Eskimo territory conditions are not likely to reach such a critical stage that such action would be contemplated.

There are no Eskimo tribes, as the term "tribe" is known in connection with American Indians. However, for convenience of reference those living in Canada have been divided into five groups, two of which are located in the Eastern Arctic and Northern Quebec—

1. The Central Eskimos, who occupy Melville and Boothia peninsulas, and the islands to the north and east thereof (including Baffin island);
2. The Labrador Eskimos who occupy Ungava peninsula.*

Although there are no tribes, these people do keep together in separate bands. The bands have no official chiefs, but usually some outstanding Eskimo, by reason of his greater hunting prowess, larger holding of personal goods, or sheer force of character, leads or guides the rest. The authority of these "chiefs" does infrequently assume more definite form. In the case of certain Eskimos near Igloolik island in northwest Foxe basin the chief takes full charge of all the food, ammunition, pelts, and other supplies. He details the various members of the band for different types of hunting, takes charge of all the game obtained, and exercises control over the amount of game killed. Offsetting a natural inclination on the part of the Eskimos to kill is a tendency to not over exert themselves, so long as they have sufficient for their immediate needs.

Intercourse between the bands is largely limited to contact with the natives hunting or trapping in areas adjoining their own. Each band secures its livelihood scattered throughout its own district which has no definite boundaries —moving about to a limited extent within that district in accordance with the movement of the game and changing seasons. There obviously can be no continuous concentration of hunters as it would mean travelling too far in search of game. Some areas will and do support a larger population than others. In bad seasons it may become necessary to look for new hunting grounds, but Eskimos are very likely to return to the old district when they think conditions have improved. The hunting and trapping grounds of Eastern Arctic Eskimos are along the coast, the sea furnishing the greater portion of their requirements in food, fuel, and clothing. A further qualification is necessary: autumn caribou hunts usually necessitate temporary absence from the coast.

In appearance the Eskimos are rather short of stature, slightly dusky of complexion, and broad of face, with quite often a Mongolian cast to the eyes. They are sturdily built and very active, have straight black hair and brown eyes. In spite of their agility however, the general rough nature of the Arctic coast-line exacts a toll in broken limbs, which are quite liable to be set improperly if no white man is available, leaving the unfortunate persons lame or otherwise crippled for life. Tattooing is no longer fashionable and can be observed only on some of the older women.

* Jenness, D: "Indians of Canada"; National Museum of Canada, Ottawa.

Due to outside influence and the shortage of native clothing material the dress of the Eskimos has undergone some change in recent years, the extent of the change depending on the game resources of the particular district. Summer clothing is cut very much on the same pattern as that for winter and to save what would probably be a tiresome description the reader is referred to the illustrations of Eskimo types. Caribou skin is without doubt the most suitable clothing material for winter travel for both Eskimos and whites, being light, warm, and sufficiently airy to prevent perspiration. In the very cold weather two suits are worn, when they can be had, one with the hair turned in and the other with the hair turned out. Caribou skin is not adapted for use in the summer months, not only because it is too warm, but because it absorbs moisture and when wet the hair falls out. In the summer the clothing is usually made of sealskin or of some cotton goods, such as "moleskin." High sealskin boots or moccasins are worn both summer and winter.

As noted before, sealskin, woollen duffel, cotton moleskin, or other woollen or cotton material may be used for any article of clothing either through necessity or fancy. The women make practically all the clothing. The portable type of sewing machine that is turned by hand is quite a common article of household equipment.

Eskimo Snow-house or Igloo

The habitation of the Eskimo is a snow-house in winter and a tent in summer, but there are variations of each. Sealskin, canvas, sacking, pieces of board, stone, and even glazed sash may go to make up the tents or houses which range from small wedge shaped tents which are easily moved from place to place, to wooden houses, or houses made of whatever material is available and which are used the year round being covered with moss and snow in the winter. Usually the tents or "tupiks" are pitched low and supported by a number of poles or ribs. Wooden doorways are fitted into the entrances to help keep out the ever-present dogs, which are always ready to steal anything edible, and whose notions of edibility are queer in the extreme.

The "igloo" is the typical winter dwelling, and has retained its original form. It is constructed of blocks cut from the hard-packed snow, and built above the first row of blocks spirally in the form of a dome. It has a low tunnel-like entrance through which one has to crawl, and quite often several

compartments are connected by these tunnels. One section of the igloo floor is left, or built, higher than the rest and forms the sleeping platform. There are variations as regards the size of snow-houses, those forming more or less permanent seasonal abodes being quite naturally more roomy than the simple overnight lodging places which can be quickly constructed by expert builders. The stone seal-oil lamps which are kept going day and night during cold weather will raise the temperature and make the dwelling quite comfortable. The temperature can be partially controlled by enlarging or making smaller the ventilation hole in the roof. Quite often the igloos are lined with canvas or sealskin to prevent drip.

The nature of the summer and winter dwellings aside from the wooden or composite houses does not tie the Eskimos down to one locality, which is fortunate from the point of view of health and sanitation. A new snow-house may be quickly constructed and a tent easily moved, and nature soon cleans up or purifies the abandoned filthy campsite. At some of the trading posts there are a few families who reside in more or less permanent homes of their own construction of the type referred to above. Unless under careful supervision the result after continued residence is anything but satisfactory. The Hudson's Bay Company and the Mounted Police frequently provide their native servants with small homes of wooden construction for use as winter residences. These are regularly inspected and kept in a sanitary condition.

Due to the extensive use of sealskin, seal meat, and seal-oil there is always a strong fishy, oily smell about the residences of Eskimos and from their persons. It is disagreeable to the white person at first but one quickly gets used to it in the North. However, articles manufactured by the Eskimos out of sealskin or even caribou skin become offensive when brought into homes in more southerly regions and one would be well advised to leave such articles where they will be appreciated and of some utility.

Before leaving the subject of Eskimo dwellings mention should be made of the Eskimo seal-oil lamp or "kudlik", that indispensable article of every Eskimo home. While many Eskimos now own single-burner gasolene or coal oil stoves a great deal of the time they cannot afford to buy fuel, and at such times the stoves are of course out of use. The kudlik is constructed of soapstone or, if that cannot be obtained, of some other easily worked stone, hollowed to about the depth of a saucer with one edge almost straight and the other side rounded, the whole being somewhat crescent shaped. A wick made out of pounded moss, cotton grass, or a type of Arctic pussy willow is spread along the almost straight edge which is also the deeper side of the lamp. The lamp when trimmed burns fairly free of smoke and with a white, pleasant flame. It furnishes light, heat for the dwelling, and the usual means of cooking. In addition it is the only means by which clothes may be dried in the winter. A rack for clothes is usually hung over the lamp.

The means of transportation in the summer is by boat, and in the winter by dog-team. The most common type of cruising boat is the open whale-boat propelled by sail. Other types are also brought in on order by the trading companies and are equipped, when the owners can afford it, with gasolene engines. Eskimos are naturally good mechanics and with a little coaching quickly learn to run, take down, and keep in repair quite complicated marine engines. They know thoroughly the districts in which they hunt and trap, also the actions of the tides, currents, and ice, and go out to sea under conditions which would keep many white men ashore. Into these larger boats will crowd three or four families and all their dogs, the dogs lying together so close that they almost resemble a fur robe. The equipment of all families is carried along but it is usually very simple, consisting as it does of a few pots and pans, one or two oil lamps, a pile of caribou skins or blankets, hunting gear, whatever food may

be on hand—food that is generally too "high" to be considered edible by a white man, but which can usually be eaten by the Eskimo with safety—and other odds and ends. In spite of the excellence of their digestive systems they do sometimes suffer ill effects from meat that has really gone bad. The boat may be so loaded down that the gunwale is within a few inches of the water, and leak so badly that the women have to "man" the homemade pump continuously, but the natives seem to travel in the picnic spirit and consider it all something of a lark. They may get into serious difficulties, but once the difficulties are past they are forgotten, which is fortunate in the Arctic.

Eskimo Boats at Cape Wolstenholme

Some of the boats are really fine, and the owners take great pride in them, and well they may, as they represent a great many pelts. In spite of their good seamanship, however, serious accidents sometimes happen. In the autumn of 1932 twelve Eskimos were drowned while on their way from Sugluk on Hudson strait to visit relatives at Sovik on the east coast of Hudson bay.

The smaller, one-man kayak is still used extensively by the Eskimos and is probably the outstanding article of equipment made by this remarkable people. The frame is made of wood strongly laced together with thong. Even the wood used to make the frame may have to be pieced together, and if it is very scarce it may take an Eskimo a whole spring to gather the wood and make the frame. The craft is narrow, covered with sealskin and usually from 15 to 20 feet long. In the Eastern Arctic it is flattened to some extent on the bottom. The skin covering is stretched, while wet, tightly over the frame and sewn with a double waterproof seam by the women. A number of women work together and complete the job in a day or two. As the deck is covered with sealskin the

kayak is quite seaworthy in the hands of an experienced Eskimo. It is propelled by a double-bladed paddle, and carries all the equipment necessary for the hunting of seals. It is usually towed behind a large boat or hoisted up on the deck when the family or families are on the move.

The sledge or komatik used in the Eastern Arctic is of necessity constructed so as to carry a considerable load and have sufficient resiliency to stand the strain caused by the rough and broken pressure ice and the rugged coastline. The runners, which are usually shod with steel, are made of pieces of birch or spruce about 2 inches thick and 6 to 8 inches wide. Crossbars are tied on to the runners with seal thong or cord and the sledge when finished is from 8 to 16 feet long and from 16 to 24 inches wide. During very cold weather when the snow is dry the runners are iced in order to reduce friction. To prevent the ice chipping off, warmed blood of the seal is ejected from the mouth of the Eskimo driver onto the runners and smoothed out. It quickly congeals and water is then added by the same means. Heavy rounded mud shoeing is sometimes added to wooden runners to reduce friction. It works very well, although a chunk may break off under hard usage and thus cause some inconvenience before the shoeing can be repaired. The mud shoeing is also coated with ice in the manner referred to above. To retard thawing of the mud in the spring a strip of caribou skin is sometimes hung along the runner on the sunny side of the sleigh. The sledge will support loads of one thousand pounds or more, depending on the size, and stand considerable abuse. In an emergency skins of bear or seal may be used as a winter conveyance, the harness being hitched on to the nose of the skin.

Snow blindness is a common complaint in spring travel. Some Eskimos are not bothered in this way. With some it is sufficient to blacken the sides of the nose and the skin around the eyes with soot. Others have to wear dark glasses or the old type of Eskimo eye protectors made out of wood or bone with a narrow slit for an opening.

The number of dogs used to draw a sledge depends largely on the resources of the driver or owner and this in turn depends to a considerable extent on the game resources of the district. It would seem that the number of dogs used by Eskimo hunters where game is reasonably good has increased considerably since the advent of the modern rifle. They can now feed a larger team than was formerly possible when primitive weapons were used. The team varies from 4 to 16 or 17 dogs, and 100 pounds per dog is a good load. Dog harness is made by the Eskimos of sealskin. The long individual traces with which the dogs are hitched to the sledges in fan formation are cut spirally from the skin of the larger bearded or square flipper seals. This latter type is usually referred to by the Eskimo term "Oojuk." Incidentally the oojuk provides soles for boots and material for other articles requiring something stronger and heavier than ordinary sealskin. Experience has proven that the fan hitch is better for open Arctic regions than the tandem hitch used in wooded country. It gives the dogs a better chance to select good footing but has the disadvantage of allowing the traces to become tangled up, due to the criss-crossing of the dogs. It is necessary to untangle these traces frequently and unless the driver is very careful the dogs are liable to start off while he is holding the ends of their lines, with the result that he may be left stranded some distance from camp and in a precarious position as regards supplies. The best trained dog acts as leader and is obviously hitched to the sledge with the longest trace. A good lead dog will save the driver a great deal of labour and worry, changing direction on command, keeping on in the desired direction in spite of obstacles which have to be gone around, and selecting the best routes.

Dog feed is a problem at times. It is, however, one of the few matters in which Eastern Arctic Eskimos are provident. They know that their own

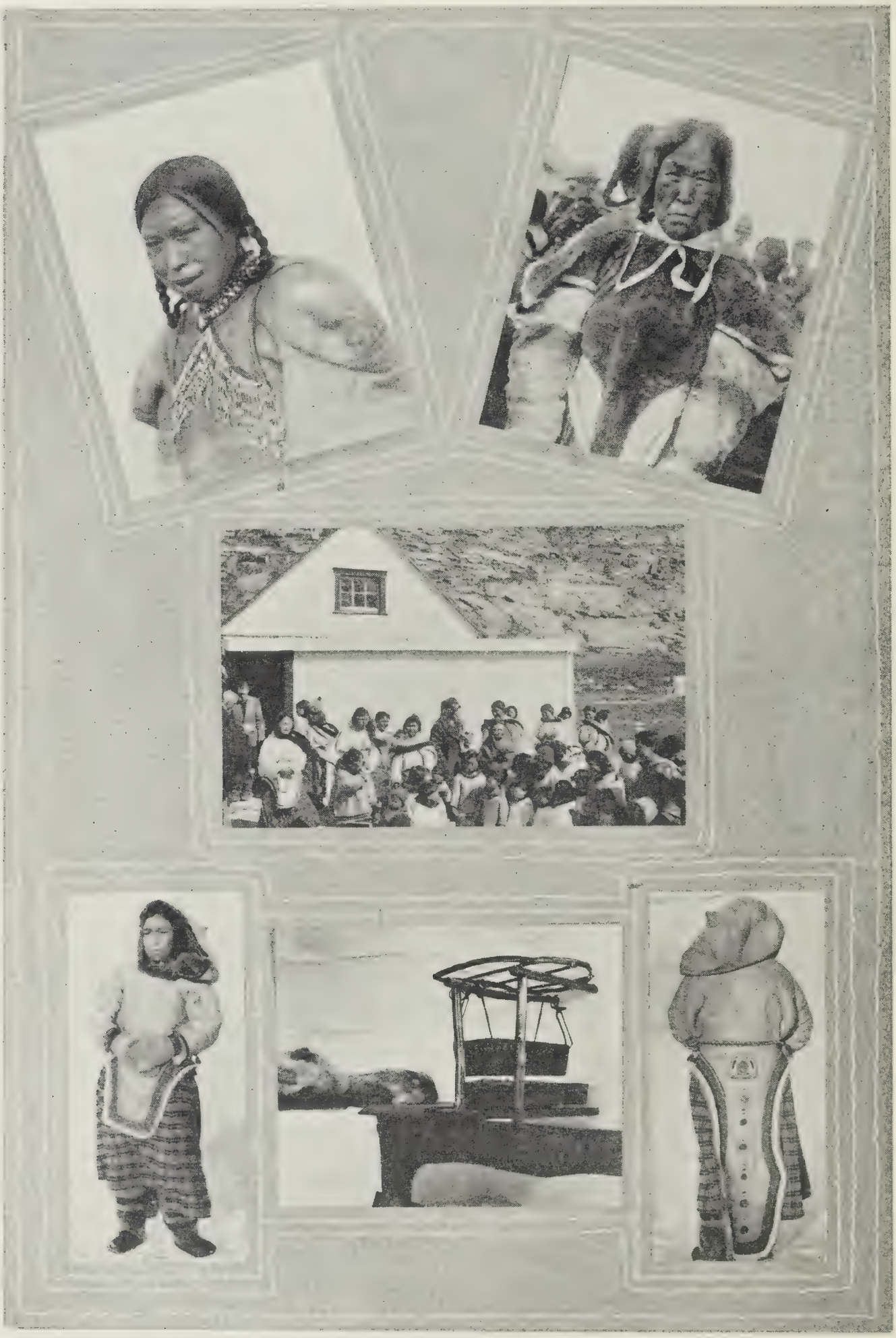
livelihood during the long winter months depends in a large measure on their dogs. A certain amount of meat is cached away during the late summer but it is seldom sufficient and may not be readily available. Eskimos do not carry very much dog feed with them in the winter, probably not more than enough for two or three days, depending on the game which they hope to secure en route or at their new encampment. For that reason they usually follow the coast in their travels rather than cut across land. Eskimo dogs are able to go for some time without food and if the hoped for game does not materialize for a few days no harm results. White men when making long winter trips carry about ten days' dog feed with them in addition to their own food and equipment. If the journey is going to take longer than that it is usual to establish caches of food in advance, especially on inland trips or on trips through areas of unknown game resources. Walrus meat is considered to be the best dog food. The skin which is about 1 inch thick is fed along with the rest of the meat and as one might imagine it has excellent staying qualities. Seal meat and some types of fish are also good.

Practically the sole medium of exchange used by the Eskimos in their dealing with traders is the pelt of the white fox. These animals have a natural cycle of abundance reaching a peak about once in four years, seemingly following about one season after the abundant lemming years. During a good fox year the Eskimos are enabled to replace their worn out gear, and satisfy their longing for new goods. Incidentally the Eskimos are rather careful buyers, and do not as a rule buy luxuries until they have secured what necessities they need. In this they are encouraged by the better traders. Very few Eskimos are able to accumulate much in the way of wordly goods or to establish credits at the trading posts—in fact allowing a credit to stand at a trading post is something that the average Eskimo cannot comprehend. The traders, of course, depend entirely on the natives for the pelts they want, and must see that they are reasonably well looked after in bad times. Consequently the trading companies usually refuse to advance luxuries to Eskimos who need ammunition, flour, molasses, clothing, or other essential equipment. Fortunately, the welfare of the traders and their trappers are closely interlocked.

In addition to the white fox, seal, walrus, and caribou are of great importance to the Eskimos. Arctic char (Arctic trout) is fairly abundant at the mouths of rivers during the months of July and August, and cod may be had in quantity at the proper season in a few localities.

The domestic relationships of the Eskimos are usually happy. They are light hearted and have a good sense of humour, and they get along well together. They are naturally fond of children but large families are not common although infant mortality would not seem to be high. If they have no children of their own they will adopt those of others, loving and caring for them as if they were their own. They also seemingly accept without visible or mental protest, the responsibility of looking after their aged and otherwise dependent relatives. The children themselves act just the same as children all over the world, the little girls playing with crude dolls and small articles representing the pots and pans and other household utensils used by their mothers. A ring of stones will probably be used to represent the tent. The boys play with bows and arrows, toy boats, and so forth. In the imitation of their parents in their play they are unconsciously preparing themselves for their later life.

Many of the women play accordions but through shyness they keep these instruments in hiding while strangers are around. The accordion seems to be the adopted musical instrument of the Eskimos and is noticed on the shelves of almost all trading posts. Some Jew's harps and mouth organs are also to be seen. At Lake Harbour a mission choir of small chidren, whose ages ranged possibly from six to fourteen years, sang a few simple hymns in a very creditable manner when the 1933 Arctic Expedition visited that post.



ESKIMO WOMEN OF THE EASTERN ARCTIC

Corners, Baffin Island types. Centre, Eskimo women and children at Cape Wolstenholme. Lower centre, Picture taken in model of Coronation Gulf Eskimo Igloo in National Museum of Canada, showing table, lamp support, stone oil lamp, stone pot, and drying rack.

The Eskimos are quite trustworthy and are invaluable companions in Arctic travel. Some of them may occasionally try to impose on a white man's generosity, no doubt, feeling there is no harm in making the effort. To him the average white man living in the North has about all in the way of worldly possessions that an Eskimo could hope for, and could share some of these possessions with him as the Eskimos do with one another. As employees of white men they are likely to obey orders without question even though they think the orders are bad. This sometimes results in misunderstanding on the part of white men, unfamiliar with this trait of Eskimo character, and who are not very specific in giving their orders.

Generally speaking Eastern Arctic Eskimos are hard and willing workers, although time is of little importance to them. It is surprising that indolence is not more common in view of their custom of sharing, which makes available pretty much for the asking, the supplies of those who have more than is necessary for their immediate requirements. A refusal to continue to furnish food to those in want, even though the needy ones show little tendency to go out and hunt for themselves, is likely to be frowned upon by the rest of the band. This must encourage laziness on the part of the few inclined to be lazy. They lay away inadequate supplies for hard times or lean seasons, which in the Arctic come all too frequently. An extra supply of meat or fish may be cached, but the tendency is to gormandize, and ease up on the hunting and fishing as long as the supplies last.

The duties of the Eskimo women are arduous and varied. They must pitch the tents when a new campsite is occupied, cook the meals—though this does not call for much mental or physical effort as meats are eaten rare or raw—scrape and dress skins for clothing, harness, lines, etc., make the clothing for the family and keep it in repair.

On the men falls the responsibility of keeping the family supplied with food and skins out of which clothing may be made. They must also secure the fox pelts so that goods may be obtained from the trading posts. Much of their time is spent hunting seals, the "staff of life" of the Eskimos. During the summer when seals can be hunted from kayaks this does not usually entail very much hardship and possibly gives the Eskimos considerable pleasure. During the remainder of the year when seals are obtained at the floe edge or at breathing holes in the ice it calls for the exercise of considerable patience and ingenuity under very trying conditions. The walrus is usually hunted in the water from the larger boats or on land. Although practically every Eskimo has a walrus or seal harpoon the rifle is commonly used. When possible it is customary to use a harpoon also so as to prevent the animals being lost by sinking. Both walrus and seal are liable to sink if killed outright in the water and not secured immediately. The latter is more likely to sink in the spring or early summer than later in the season. Some Eskimos try to wound these animals first and then get the harpoon into them before giving them the " coup de grâce."

Caribou hunts are arranged in the autumn particularly for the hides which are required for winter clothing, although, of course, the Eskimos live on the meat of the caribou during the hunt. In the Eastern Arctic it is usually necessary to go some distance inland for caribou and a month or two months or more may be spent in travelling and hunting. Dogs are taken along to help "pack" the meat and hides. A good pack-dog can carry a load of 35 or 40 pounds. When there are any surplus hides or meat they are cached under rocks and picked up when winter travel with sledges is possible. Usually only part of the band go caribou hunting the rest remain at the coast securing a supply of seal and walrus meat and blubber.

Birds are killed with a small bore rifle or bird dart. Fish are obtained by the use of spears or nets.

Polar bear are not usually hunted purposely but are killed when sighted. Some bands of Eskimos, however, do organize hunts in the spring when the skins are at their best. Rifles are usually used but spears only are still used in some localities.

The Eskimos are naturally law-abiding, and crime is quite uncommon. Murders occur infrequently and seldom through anger. In applying the white man's law, full cognizance is taken of all the circumstances and the case treated with sympathetic understanding of the workings of the native mind. The court of justice is usually held as near as possible to the locality in which the offence was committed and opportunity is taken to explain the seriousness of the crime and the necessity of abiding by the law. In this way, and with the assistance of other educative agencies, progress is being made in the prevention of crime.

In the foregoing an effort has been made to picture the Eskimos of the Eastern Arctic in a general and reasonably representative manner. As has been pointed out before, customs in regard to clothing, equipment, food, and other matters differ in various localities and amongst individual Eskimos, depending on the game resources of the different areas, the extent to which the natives have been influenced by white men, and individual fancy. However, Eskimos are encouraged to follow their natural mode of living and not to depend upon the white man's food and clothing which are unsuited to their needs.

MISSIONS, SCHOOLS, AND HOSPITALS

Christian missionary work amongst the Eastern Canadian Eskimos commenced over a century ago, the Moravian Brethren having visited Ungava bay in 1811. The Moravians have withdrawn from the Canadian Arctic and the good work is being continued by the Church of England in Canada and the Roman Catholic Church. Missions are maintained as follows:—

Church of England—

Pond Inlet
Pangnirtung
Lake Harbour
Southampton island
Fort Chimo (Quebec)
Port Harrison (Quebec)
Fort George (Quebec)

Roman Catholic—

Pond Inlet
Igloolik
Repulse bay
Southampton island
Fort George (Quebec)

The Right Reverend A. Turquetil, O.M.I., Bishop of Hudson Bay, who has spent most of his life as a clergyman with the Eskimos, is in charge of the Roman Catholic missions in the Eastern Arctic. The Right Reverend A. L. Fleming, D.D., Bishop of the Arctic, who has also been a missionary in the Eastern Arctic field, is in charge of the Anglican missions.

Quite naturally and properly the missionaries consider that their religious work is of first importance, but in conjunction with their religious teaching they instruct the children in simple arithmetic, writing (mostly in Eskimo syllabic), geography, and other simple subjects which are likely to be of the most utility.* There are practically no white children in the eastern part of the Northwest Territories.

The thoughts and conversations of the Eskimos centre largely around the all-important subject, food, and its co-product, clothing. Game in quantity cannot be obtained close to the missions or trading posts, and as there are no boarding schools in Eastern Canada north of Fort George the opportunities for religious or educational work amongst the Eskimo children are infrequent.

From the standpoint of food, clothing, hygiene, and the maintenance of self-dependence, it is important that Eskimos be discouraged from remaining in close proximity to the posts. Experienced missionaries appreciate this and plan their work accordingly. However, the natives must come in occasionally with their pelts to secure ammunition and other necessities, and the opportunities thus presented are taken advantage of by the missionaries. In addition, most missionaries make it a point to spend a portion of their time out with the Eskimos, not only to secure fresh meat for themselves and their dogs, but in order to get to know the natives better and obtain their confidence; or, as it has been expressed by one missionary, to get inside the mind of the people they are endeavouring to help.

The educational requirements of the Eskimos in this region are very simple, and their mental capacity to assimilate academic teaching is limited. Contact with white men is at present largely confined to traders, missionaries, and Government officials. The established traders, who are in the Territories for commercial purposes, have the interests of the Eskimos at heart. Not only

* It should be noted that the late Rev. E. J. Peck, D.D., who spent so much of his life as an Anglican missionary amongst the Eskimos of the district covered by this report, wrote a very useful Eskimo grammar.

because the welfare of one is bound up closely with the welfare of the other, but because most of the post managers and their assistants get to like these simple, cheerful, and hardy folk.

The Eskimos sometimes pass on their knowledge of syllabic to one another when there are no white teachers about, and it is not uncommon to hear of Eskimos who have never been to school corresponding with friends by this ingenious method of writing. Of course the postal service is provided by some other obliging friend who happens to be going in the right direction.

The Dominion Government, through the Department of the Interior, makes a grant to all mission schools in the Northwest Territories, provided the attendance averages a certain specified number. The required minimum is low, and the size of the grant in the case of residential schools depends on the number of pupils in attendance. In addition to this grant, school supplies are furnished by the department. In cases where the attendance is too low to warrant a grant, the department assists by furnishing school supplies.

HOSPITALS

As is the case with schools, all hospitals in the Northwest Territories are operated by the mission authorities. Only one hospital is situated in the district covered by this report. It is at Pangnirtung, on Baffin island, and is owned and operated by the Church of England in Canada. The Department of the Interior assists by maintaining a medical officer at Pangnirtung, paying the salary of a qualified nurse, paying a grant for each patient treated in the hospital, and an extra allowance in the case of destitute patients.

The Pangnirtung hospital is well laid out and constructed. It provides ample accommodation for present needs. An electric generating plant to furnish light for the hospital, and power for modern X-ray equipment, was recently installed. Both articles of equipment were presented to the hospital, through private philanthropy. The mission authorities have a matron in attendance at the hospital.

The Roman Catholic Church operates a hospital at Chesterfield, and although, as mentioned above, it is not in the district under discussion, it does serve the Eastern Arctic to some extent. It is operated under the same arrangements, so far as departmental assistance is concerned, as the hospital at Pangnirtung.

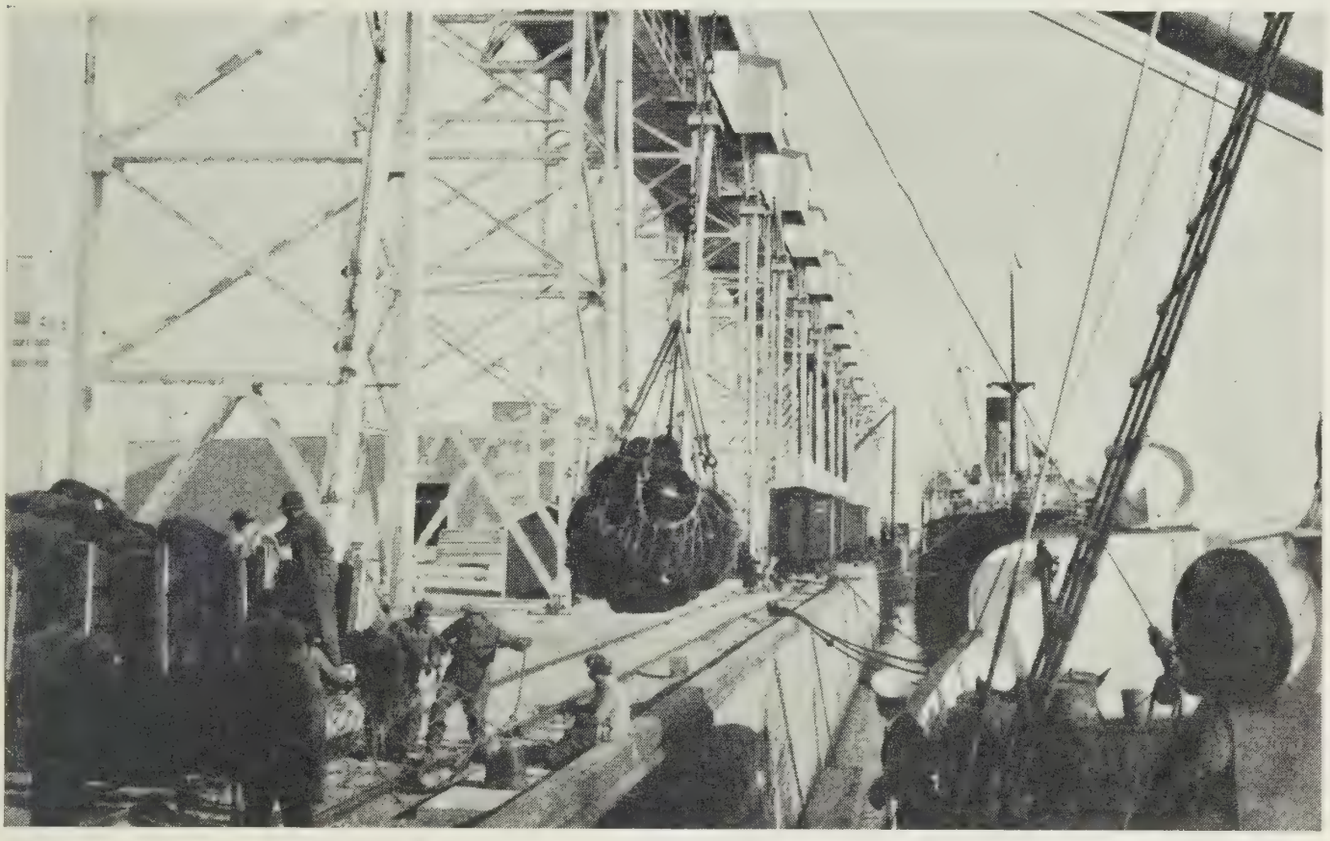
The scattered nature of the population, and the necessity for keeping expenditures within reasonable bounds, makes it extremely difficult to provide adequate medical service. However, to aid in this direction as much as circumstances will permit, the department furnishes missionaries, who quite frequently have had some medical training, with medical supplies so that they may be in a better position to afford relief to those natives who come to them suffering from minor ailments. The Royal Canadian Mounted Police posts and the Hudson's Bay Company's posts are also furnished with medical kits, by their respective headquarters, and are always ready to give what assistance they can. In addition, a qualified medical officer always forms part of the Government party on the annual Eastern Arctic Expedition. He goes ashore at each port of call and provides the skilled medical or surgical service that may have been lacking since the previous year.

Natural curiosity, the desire to meet friends whom they expect will be on hand, and the opportunity of securing a small quantity of trade goods by helping to unload cargo, all have a tendency to draw Eskimos (within reasonable travelling distance) to the northern posts about the time of the expected arrival of the annual Canadian Arctic Expedition. For the past two years one ship has been utilized to carry both the Government expedition and the year's

supplies of stores for the traders, thus making the event of double significance. This affords an excellent opportunity, once a year, for ascertaining the condition of health of many of the natives and providing treatment when necessary.

RELIEF OF DESTITUTION

While the Eskimos need never be unemployed, they are indirectly affected by any situation in the outside world which lowers or raises the price of pelts. In addition, the bad fur years which occur at more or less regular intervals increase the difficulty for the native hunter of maintaining himself and his family. Besides this, casualties are suffered by heads of households, so that provision has had to be made for the issue of relief to prevent undue hardship.



Loading Green Buffalo Hides at Churchill for Distribution to Needy Eskimos

The Northwest Territories Council recently reviewed the whole question of relief distribution, and recommended to the Minister of the Interior—with a view to the centralization, where possible, in each district of the authority for the granting of relief—that where there was a medical officer he be in charge, and where there was no medical officer the non-commissioned officer in charge of the local Royal Canadian Mounted Police detachment be empowered to authorize the issue of relief. Where there was neither medical officer nor police in the neighbourhood, the issue of relief would, of course, have to be looked after by someone else—usually the manager of a trading post. In such instances full reports are required by the Department of the Interior. The above recommendation was approved and put into effect last year.

Wherever possible relief is issued in the form of ammunition so that the natives will be encouraged to get out and shift for themselves, which they are quite willing to do—incidentally obtaining that type of food which experience has proven is the best for them. The larger trading companies undertake that where they enjoy a monopoly of trade there will be no need of the Government advancing relief to destitute natives, since those who are destitute depend upon

the hunters whose exertions in securing pelts constitute the basis of the companies' trade.

Dried buffalo meat, obtained as a result of the slaughter of surplus animals from the Government herd at Buffalo National Park, Wainwright, Alberta, has been utilized as an emergency Eskimo relief ration. It is a good food, and in its concentrated form will keep for a long time. Another point in its favour is that the Eskimos are not particularly fond of it and consequently are not likely to ask for it unless they are in real need, and the chances of obtaining seal, walrus, or other fresh meat, are poor. Its weakness probably lies in the fact that it does not contain enough fat for use in the Arctic, but along with seal or walrus meat it provides a very nourishing dish. An interdepartmental committee has the matter of relief rations under advisement at the present time, with a view to determining whether some change in the form of emergency meat ration would be advisable.

In certain areas caribou have become very scarce, with the result that difficulty has been experienced in obtaining an adequate or even limited supply of material for bedding and winter clothing. As an experiment five hundred raw buffalo hides were taken north last year. The buffalo hides are too heavy for clothing, but it is anticipated that they will provide excellent bedding. Instructions were issued that the hides were only to be given out to those Eskimos who could not obtain caribou, and who had no means of providing a substitute.

The Eskimos are a very fine race of people, and care is being exercised in the distribution of relief so that indolence may not be encouraged, nor their sense of self-dependence unduly weakened. At the same time it is the Administration's desire to do what it can to prevent undue suffering.

INDUSTRIES

FURS AND THE FUR TRADE

The fur trade more than any other industry was responsible for the primary opening up of the developed parts of the North American continent. It is of necessity a frontier occupation and has always had a strong attraction for those of pioneer characteristics. Having this in mind the Eastern Arctic may be said to be still in its infancy so far as industrial development is concerned, although the "infant" is of mature years as the Hudson's Bay Company's ships have been sailing into Hudson and James bays for over 260 years. At the present time the Company has the Eastern Arctic fur-trade almost exclusively in its own hands. Private traders have operated in the past but have retired from the field. At Repulse bay and in northern Quebec the Revillon Freres Trading Company operates posts, and in addition a few private traders still carry on business in that province.

Anyone may secure a licence to trade provided he submits evidence satisfactory to the Department of the Interior of his bona fides, and provided the Department considers it would be in the interests of the native population to have a post in the locality mentioned in the application. As an extra precaution it is usual to submit all doubtful applications to the Northwest Territories Council for consideration.

The Hudson's Bay Company secures recruits for its Eastern Arctic trading posts principally in Scotland and England. Perhaps the distance, difference from other countries, and romance of Polar Regions help the Company to secure the fine type of employee it does. The post buildings are usually well designed and constructed and the Post Managers and their Assistants vie with the Police and others stationed in the neighbourhood in giving their premises a well-groomed appearance. Lawns are not possible, but they can and do provide paths, bordered with white-washed stones, and well raked gravel patches. At Lake Harbour the employees of the Hudson's Bay Company constructed a tennis court which because of its contours would perhaps place visiting players under a handicap but which represents a great deal of hard work. Besides pleasing those employed at the posts this practice of beautifying the grounds provides a good object lesson for the Eskimo population.

The shelves and store rooms of trading posts are usually well stocked with goods for which there is a demand—flour, rolled oats, biscuits, sugar, molasses, tea, canned goods, tobacco, dry goods, rifles and ammunition, general hardware, gasolene, oils, and so on. The quality of the merchandise is generally good, and the quantity limited to little more than the normal requirements of the areas served. Cash is almost unknown. Answering a remark that it is sometimes suggested that the natives do not receive fair treatment from the traders, one of the senior officials of one of the larger companies pointed out that the fact that there were practically no private traders in the Eastern Arctic indicated that the present traders were not endeavouring to abuse the privileges they enjoy.

It should be noted also that the Northwest Territories Council requires all traders to furnish periodical statements of the prices charged for commodities and the prices allowed for furs, also to issue counterslips covering individual transactions.

Of the furs taken in the Eastern Arctic the pelt of the white fox is of much more economic importance than all the rest put together. A few seal skins,

polar bear skins, and ermine pelts are also exported, but they are of minor importance numerically and from a financial standpoint. In the more southerly regions some coloured pelts are also taken. In Ungava, in addition to the purely Arctic type of fur-bearing animals, red, silver, and cross fox, marten, mink, otter, a few beaver, and black bear are traded.

STATEMENT SHOWING THE AMOUNT OF FUR EXPORTED EACH FISCAL YEAR OUT OF THE EASTERN ARCTIC SINCE THE FUR EXPORT TAX ORDINANCE BECAME EFFECTIVE.

Fiscal Year	Polar Bear	Beaver	Fox				Muskrat	Weasel	Wolverine	Wolf
			Blue	Cross	Red	White				
1930-31...	395	18	114	16	26	7,960	281	121	1	.....
1931-32...	88	.....	324	.....	.....	23,016	.....	79	.....	.....
1932-33...	11	.....	15	.....	.....	1,047	.....	12	.....	.....
1933-34...	157	.....	84	.....	.....	6,368	.....	256	.....	1

WHALING

When the whaling grounds in the vicinity of Spitsbergen began to show signs of depletion, so far as commercial operations were concerned those engaged in the whaling industry directed their attention to Davis strait, where Baffin as early as 1616 reported the existence of a promising new field, and later to the area farther north in Baffin bay, where Ross and Parry reported having seen whales in large numbers. The whalers left their home ports early in the spring and arrived in the Arctic while winter conditions still existed. The "middle pack" exacted a fearful toll in ships and lives, it being a common experience for from 10 per cent to 40 per cent of the vessels visiting the Baffin Bay area each year to be crushed by the ice. It was not the natural hazards that eventually terminated the whaling in these northern waters but rather a repetition of what occurred in the Spitsbergen area, *i.e.* the reduction of the number of whales to such an extent that it was no longer possible to operate with a profit.

During the past century while the whale fishery was being conducted off the Baffin Island coast large numbers of Eskimos were given employment on board the boats or on shore at the whaling stations, and eventually through force of habit they came to depend on this annual employment for their very existence. Whaling was also carried on in northwestern Hudson bay. The Right whale or Greenland whale, hunted by the whalers in the Arctic, became scarce and the whaling industry in Davis strait, Baffin bay, and Hudson bay gradually passed out of existence.

For some time the Hudson's Bay Company has been conducting an annual drive of white whales at the head of Kingua fiord, Cumberland sound. One drive only is made in each year, unless the first attempt is a failure, at or about the time of the first "spring" tide following the clearing of the fiord of ice—usually in July. These sea mammals it is reported become thinner as the season progresses so that the earlier the drive can be made the greater will be the quantity of oil obtained. Strangely enough the stomachs of the white whales killed in this area are nearly always empty, although they remain in the fiords for quite a long period each summer. All the natives available, with their motor or other boats, are employed during the actual drive. The boats form up in a line and, creating as much disturbance as possible, gradually drive the timid animals in close to the shore where they are held until the tide goes out. The stranded animals are then killed with rifles. As many as 700 whales are taken

in a single drive. The skins are exported and used for fine leather goods and the oil is rendered at a blubber plant at Pangnirtung, both skins and oil being shipped out. The rest of the carcass is not made use of, although as a result of the drives the dogs at Pangnirtung probably feed better during the summer months than the dogs at any other point in the Eastern Arctic. The Eskimos consider the skin of the white whale a delicacy and eat it raw or partially cooked. It is not usually relished by white men and has been described as resembling tripe in substance.

WHITE WHALES TAKEN NEAR PANGNIRTUNG, BAFFIN ISLAND
(Courtesy Royal Canadian Mounted Police)

This annual drive, and the work resulting therefrom which usually lasts for some weeks, gives employment to Eskimo men and women and thus is of some value to the natives. There is, however, the other side to the situation, as has been pointed out by a departmental officer. The natives engaged by the Company in the rendering of the oil and the preparation of the hides are unable to participate in the inland caribou hunts and have to go short of caribou skins for clothing for the winter.

OTHER INDUSTRIES

A small quantity of coal is mined each winter at Salmon river near Pond Inlet. It is used at Pond Inlet and at one of the nearby trading posts, but so far the development has not assumed commercial importance. The mining and exportation of mica, graphite, and garnet have been attempted in the past but discontinued.

FLUCTUATIONS IN WILD LIFE

By Charles Elton, M.A., Bureau of Animal Population, University of Oxford, England.

Anyone who has lived for a good many years in one place will have noticed the tendency for the numbers of wild animals and birds to fluctuate from year to year. Particularly is this so in Arctic regions. The writer has had no first-hand experience of these wild life fluctuations in Northern Canada, but happens to have had access for some years to a large number of records kept by the Hudson's Bay Company and other organizations, while at the same time studying the problem at first hand in Britain, Norway, and Spitsbergen. The statements made in this article are necessarily brief summaries of larger studies that have been or are being published.

In a country where both white men and natives depend in the main upon wild life resources for their living, fluctuations in wild life assume a serious importance, and we are at once led to inquire how regular they are and what are their causes. The most important and striking fluctuations in the Canadian Arctic are found in the Arctic fox (the white fox of the fur trade), lemming, snowy owl, and ptarmigan. The fox is important because of the value of its fur and the fact that it apparently transmits disease to sledge dogs, the lemming because it forms the staple food of the fox and mainly controls the fluctuations of the latter, the snowy owl because its migrations south in years of lemming scarcity provide a remarkably clear index of Arctic fluctuations, and the ptarmigan both as a food supply of man and of the Arctic fox. Other animals also fluctuate, and brief mention will be made of them later.

First let us consider the periodic fluctuations of the lemming, ptarmigan, fox, and snowy owl. They all appear to ebb and flow, in numbers, more or less together, and the period of fluctuation averages four years, varying sometimes to three or five. This rather regular cycle is liable to be apparently upset by a good many local conditions, of which perhaps the most important are the movements of the sea-ice on which Arctic fox travel to a great extent in winter. Such variations in the number of migrating fox visiting a particular post produce apparent exceptions to the regular fluctuation in numbers, but the existence of the latter is very clearly seen if we study a large area. Such mapping of years of abundance and scarcity is made possible partly by the study of fur returns, and partly by the observations of men living in the North, and it frequently happens that the true significance of these observations only appears when a large region is studied. There is here a great opportunity for anyone who inclines to take an interest in wild life, to make valuable contributions to science by keeping careful records of changes in numbers, migrations, epidemics, and habits of fluctuating species. The success of the annual snowshoe rabbit inquiry carried out by the National Parks Branch of the Department of the Interior in more

southerly regions, and the great value now of the diaries kept for so many past years by the Hudson's Bay Company men, are sufficient proof of the fact. In making observations on abundance it is most useful to make comparisons from year to year: "Arctic fox more abundant than last year" etc.

To return to the four-year cycle: the years of Arctic fox abundance at Fort Chimo between 1880 and 1928, taken from Hudson's Bay Company fur returns, were 1882, 1887, 1890, 1893 1897, 1901, 1905, 1909, 1913, 1917, 1921 and 1926. In this period of forty-eight years the interval between years of abundance was in seven instances four years, in two instances three years and in two instances five years. In between each of these "good" years there were extremely "bad" years when fox were very scarce. Even without attempting exact forecasts the existence of such a violent fluctuation would have to be taken into account in planning native welfare or fur-trade operations. Scientific work now in progress leads us to hope that successful forecasting will improve rapidly from year to year. Generally speaking, the greater the amount of fluctuation in a staple commodity the greater the amount of reserve capital required to guard against the effects of the fluctuation. And the better the forecasting system the less reserve will be tied up, fewer disasters, less waste, and less instability in working plans.

This leads to the question of amplitude—what is the range of fluctuation? If we work on fur trade figures for the whole of Canada's white fox production, we find changes in supply of from one in two to one in five. Thus, Hudson's Bay Company returns for all their districts showed in round numbers about 3,000 in 1909, 4,500 in 1910, 14,500 in 1911, down again to 6,000 in 1912 and finally to about 4,000 at the bottom of the cycle in 1913. The white fox production for the whole of Canada given by the Dominion Bureau of Statistics was in round numbers about 18,000 in 1919-20, 21,000 in 1920-21, 41,000 in 1921-22, 77,000 in 1922-23, and down again to 35,000 in 1923-24.

We do not know, however, to what extent the percentage of the white fox population skimmed off by trappers varies each year. On the whole it seems probable that the fluctuation is greater than is indicated by the returns. When we examine one particular post it is to be expected that the amplitude of the fluctuation would be enormously greater, since it would not appear likely that all posts fluctuate together. The figures from Fort Chimo show that the variations in foxes caught at that post may normally run from one in four to one in twenty, and sometimes more than this. But the fact that the all-Canada figures do show such a pronounced cycle indicates that the smaller districts do not fluctuate entirely at random, otherwise they would tend to cancel out.

We next have, therefore, to notice that the fox cycle is not a local affair. There is probably no place in Arctic Canada where foxes maintain level numbers from year to year. A search of records from other parts of the world has shown that similar great fluctuations occur in all parts of the Arctic—Canada, Greenland, Scandinavia, Siberia, Kamchatka, and Alaska. If we map the distribution of fox abundance in any particular year in Eastern Canada, we find that increase and decrease usually takes place simultaneously over hundreds and even thousands of miles of country. Thus 1926 was a good fox year over the whole of Ungava, Hudson strait, Baffin island, and northwest Hudson bay. In 1928 great

scarcity was noticed over the whole of this region. In some years, however, the maximum covers about half this region, being followed by the other half in the next year. This which seems to be the usual course, occurred in 1917-18 and 1921-22. But the behaviour of the cycle is always fairly regular geographically, and this suggests that some factor outside the fox population is controlling its periodicity.

What is the cause of the cycle? Why is it so regular? What controls its regional distribution? It is pretty well recognized now that the actual fluctuation in foxes is directly caused by two things: food supply and disease. The white fox depends mainly on lemming for food. Lemming are fairly near relations of the meadow mouse and mostly replace the latter in Arctic regions, where they lead much the same life, eating the vegetation of the northern plains and tundra, and remaining active under the snow in winter. Lemming fluctuate very violently in numbers, and this fluctuation in turn affects the fox. When lemming reach their periodic maximum of numbers, they either die of epidemic disease or migrate, sometimes out on to the sea-ice, where they perish. When lemming are scarce, fox starve or die of disease. There is an interesting confirmation of the idea that the regular four-year cycle in Arctic fox is caused in turn by that of the lemming. Fox have this rather regular short cycle in Canada, Alaska, parts of Siberia, and in Norway. But in Spitsbergen and West Greenland, although great fluctuations take place, there is no regularity in them. In the former places lemming occur and fluctuate. In the latter places there are no lemming. But in all these localities fox suffer from periodic epidemics. To this question we may now turn.

The disease that attacks white fox appears to be very similar if not identical with a nervous disease, known as encephalitis, which causes disastrous epidemics on silver fox farms in Canada and the United States. This disease has been shown by Dr. R. G. Green of Minnesota University to be quite distinct from dog distemper, since the latter kills ferrets and the former does not. Nevertheless there is strong evidence that the Arctic fox disease is infectious to sledge dogs, among which it causes serious losses in certain years. It can of course also be conveyed from team to team, and at times develops into wide pandemics, as in 1931. It is not certain, though probable, that the disease can also become endemic among dogs and flare up without introduction from wild foxes. Dogs should on no account be given the meat of sick foxes. The disease occurs all round the Arctic regions, e.g. in West Greenland, and therefore does not necessarily have any connection with lemming. But specimens of banded lemming from Hudson strait, brought to Oxford, developed spontaneously in the laboratory a disease resembling encephalitis. In general, very little is yet known about natural epidemics in the lemming.

The nervous epidemic of foxes and dogs has very variable symptoms according to the part of the nervous system which is attacked. Usually the animals go crazy, but not necessarily savage, run about in straight lines, foaming at the mouth, and finally get paralysis of the legs and die of great weakness. No cure is yet known, but research is being directed to that end. The chief difficulty is obtaining fresh material for examination by scientists.

In the years of lemming scarcity fox are especially liable to these epidemics, and at the same time they undertake extensive migrations. These migrations are of importance in two ways: the posts in the north lose their fox and those

far to the south often make large catches, and at the same time the danger of disease is spread over a very wide region. These migrations are of great importance in the fur-trade and native life, since they bring with them at the same time possibilities of wealth and of losses or hardship.

We have traced the fox cycle to the lemming. What makes the lemming fluctuate regularly? We do not know as much as we would like about Canadian lemming cycles. Those in Norway have, however, been very fully studied, and the fox-lemming situation is much the same there as in Canada. The evidence, not at hand, suggests strongly that there is some regular climatic pulsation, probably in the form of a variation of storminess, wind direction, or winter snowfall, which affects the life of lemming, probably in winter. The circumstantial evidence for this general theory is almost overwhelming, but it must be admitted that we know little about the exact nature of the climatic cycle as yet. Observers can render good service to science by noticing weather changes from year to year, particularly the depth of snow and direction of prevailing wind.

Back's Lemming, (Brown Lemming), Bowman Bay, Foxe Basin, Baffin Island.

With regard to the snowy owl: Dr. A. O. Gross has shown how there is a four-year cycle in the appearance of great numbers of snowy owl in autumn far south of their summer breeding range in the Arctic. These years coincide with the disappearance of lemming, as deduced from fox cycles. And the ptarmigan: it is generally believed that the ptarmigan fluctuates in the same way as the lemming. It is necessary to have more information before we can speak of this with certainty, but a similar correlation between willow grouse and lemming and fox has been noticed in Norway.

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Other animals in the Arctic are affected by fluctuations. Thus the caribou are said to be in much better condition in some years than in others. And there is the important problem of the periodic changes in their migration routes, the cause of which is not yet settled. Arctic hares appear to fluctuate to a large extent, but there is not enough information to say what periodicity they show, whether it is four years, like the fox, or ten years like the allied snowshoe rabbit in the forests to the south. Polar bear fluctuate locally, but this is mainly due to the erratic movements of the polar ice. Sea-fish also vary much in numbers, and recent years have seen a remarkable movement of cod northwards to the Greenland coast. Sufficient has perhaps been said to show the instability of wild life in the north, the importance of finding out all we can about these fluctuations, and of making systematic investigations through the aid of observers stationed in these regions.

MAMMALS OF THE EASTERN ARCTIC AND HUDSON BAY

By R. M. Anderson, *Ph.D., National Museum of Canada, Department of Mines, Ottawa*

The Eastern Arctic as treated in this report includes the Canadian Arctic archipelago west of Greenland (Ellesmere, Devon, and Baffin islands on the east and Melville, Prince Patrick, and Prince of Wales islands on the west), to Boothia peninsula, including Melville peninsula, Southampton and other islands in Hudson bay; also the south side of Hudson strait from Port Burwell at the eastern entrance, the east side of Hudson bay and the shores of James bay around to cape Henrietta Maria at the northwest angle of James bay.

While the Eastern Arctic region north of Hudson strait is a region of fairly uniform boreal conditions, with a relatively homogeneous circumpolar fauna, the inclusion of the shores south of Hudson strait and a somewhat indefinite hinterland including both the eastern and western shores of James bay, introduces quite different physiographic and climatic conditions, which are reflected in the fauna and flora.

From the purely geographical standpoint, the Arctic Zone is taken as the region north of the Arctic Circle latitude 66° 33′ 04″ north, but from the standpoint of biologists, students of the distribution of animals and plants, it has been found useful to map out Life Zones. The Arctic Life Zone is roughly marked at the northern limit of the growth of trees including all the region north of Hudson strait, a large part of the east coast of Hudson bay, the south shore of Hudson strait, and extending southeast as a narrow fringe along the Atlantic coast of Labrador as far as the strait of Belle Isle and a small part of Newfoundland. South of the Arctic Life Zone with a very irregular boundary is the Hudsonian Life Zone, a region of comparatively scanty timber, characterized principally by white and black spruce, interspersed by muskegs and barren hills. The Hudsonian Life Zone covers the greater part of Labrador and northern Quebec. In this region the Canadian Life Zone reaches north about to the southern end of James bay, and its northern edge stretches eastward from there to the gulf of St. Lawrence. The Canadian Life Zone is heavily forested and dominated by pine, hemlock, fir, and spruce.

In preparing lists of mammals we find that the true Arctic region of the Northern Plains and northward is easiest to summarize. The species are few in number and fairly uniform owing to similar conditions over vast areas, and while we do not always have sufficient material to map exactly the distribution of all species or settle all moot problems, the fact that many exploring expeditions and a number of persons interested in natural history have been able to winter in the Arctic, has resulted in fair collections being brought out.

South of Hudson strait, we find that cold ocean currents have made the Labrador coast from cape Chidley to the strait of Belle Isle essentially Arctic, although far south of the Arctic Circle. The hinterland of the Newfoundland section of Labrador and the southern part of the region west of it is more or less forested, heavily in some of the more southern valleys, and thinning out northerly into the scattered, scrubby forest at the northern limit of tree growth. Published notes on the wild animal life of this region are scanty as virtually all zoological work has been done at scattered stations along the coasts, and the few traverses of the interior have been made by fur-traders, geologists, topographers, prospectors, or timber cruisers, who have been fully occupied with their own work, and usually unable to bring out collections of

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other things over the difficult portages. The result is that a vast territory measuring about 990 miles east and west (from the strait of Belle Isle to cape Jones on the east side of James bay) and about 840 miles north and south (from Cape Wolstenholme on Hudson strait to the south end of James bay) is zoologically very imperfectly known.

LIFE ZONES OF NORTH AMERICA

(Based on maps of Merriam, 1893, 1898; Merriam, Bailey, Nelson, and Preble, 1910; Brooks and Swarth, 1925; Seton, 1925); revised by Anderson, 1934.

This semi-forested sub-Arctic region, a large part of which lies in the Hudsonian Life Zone, shows many forms of Arctic plants and animals, merges almost imperceptibly into the heavier forested regions farther south, and brings intrusive forms of plant and animal life which are more typical of temperate

climes. Lack of facility for movement, a long period of isolation and interbreeding, combined with different environment, have resulted in the circumpolar species developing slightly different geographical races, or subspecies, on the south side of Hudson strait and east of Hudson bay. This differentiation is less marked in the bird fauna, as the birds migrate freely across seas, bays, straits, and large lakes, while the mammals as a rule are fixed in their habitats. The caribou is the only northern mammal which regularly migrates, moving seasonally from one grazing ground to another, and even caribou are apt to remain in some numbers on any part of their range at all seasons of the year. Wolves follow the caribou to some extent in winter, and Arctic foxes move about irregularly, particularly in the cyclic periods of greatest abundance of foxes when the food supply has become depleted. Nevertheless, these movements are restricted by the absence of solid ice bridges across Hudson strait and the absence of food for land mammals while making long traverses on the ice; also by the dislike of forest species for the Northern Plains.

The waters surrounding the region are essentially Arctic, and the sea mammals are virtually identical. While the land mammals south of Hudson strait are in many cases closely related to the more northern forms, the races on the whole are fairly distinct and it seems best to treat the land mammals of the two regions in separate lists.

For a century or more it has been known that the species of fur-bearing mammals, more particularly of the sub-Arctic districts, produced fur of different qualities, in different regions, and these geographic distinctions are well known to expert fur-buyers.

To some extent systematic zoologists have attempted to correlate and classify some of these variations, and in many cases for convenience and clearness in scientific references have given formal scientific names to geographic races, calling them varieties or subspecies. Owing to the difficulty and expense of obtaining adequate specimens with authentic data regarding origin (locality, or place where a specimen is taken) many races of mammals have been named and described on the basis of a few skins (often imperfect or in poor coat) or from the characters shown by a few skulls. The difficulties of a research worker are obvious when he attempts to identify either a skin or a skull of an inadequately described or imperfectly known species. Not one museum or private collection in Canada has anything near to an adequate study collection of Canadian mammals, and if a student of animal life wishes to see a typical specimen of many of the forms, he will find none available in Canada. This applies most strongly to the different races of fur-bearing mammals, as the rarer forms are mostly found in distant or inaccessible districts and few natural history museums have had the funds or ambition to send collectors into the different sub-Arctic districts, or to arrange with professional trappers or fur-traders for the purchase of specimens.

The fur-bearing mammals of Canada, which alone have for many years been producing from ten to twenty million dollars worth of raw furs in Canada annually, form the whole income of many native tribes, particularly in the Arctic and sub-Arctic regions, and are an important resource of the pioneer settler. The large game mammals are essential as part of the food supply of the north, and no animal is so small or obscure that it does not have some significance in the life of the higher forms, in many cases greater than we know. Considering the economic and scientific importance of so many of the Canadian species and the many classes of people (hunters, trappers, fur-buyers, settlers, fur-manufacturers, fur-wearers, scientists, and conservationists) who should be interested in furthering our knowledge of this subject, it would seem a worthy object for some of our public-spirited citizens to become interested in the building up of better Canadian collections for reference purposes.

In this paper the writer has attempted to list all recognized species and subspecies found in this region, and to clarify some of the earlier records which are difficult to understand on account of confusion in scientific nomenclature and geographical names which have had different meanings at different times. The boundaries of the Northwest Territories, Ungava, and Labrador (Canadian and Newfoundland) have been shifted, and other changes have been made for political reasons, but the Life Zones remain the same. Whether we can map them correctly or not in the present state of our knowledge, the wild life crosses the boundaries at will. As the Government departments concerned with the region in question are showing an increased interest in the wild life, and are trying to obtain further information, it has also been thought wise to call attention to the gaps in our knowledge, with the hope that future investigators in the region may be able to fill them. The field is too large for any one person to cover personally and our knowledge must be built up by the observations and collections made by many individuals. A small note contributed to knowledge may fill an important gap in the picture of our wild life.

SEA MAMMALS

The sea mammals of this region are divided into two distinct groups (1), the Cetaceans (Whales and Porpoises), which although air-breathing mammals are adapted to a strictly aquatic life; and (2) the Pinnipeds (Seals and Walruses), which derive their food from the water, and spend the greater part of their life in the water although they spend much time out of water, resting upon ice floes or upon rocks or sandy beaches. The Pinnipeds as a whole are fairly well known, although the ranges of some of the rarer species are not fully known. As the sea mammals are essentially the same from the northern to southern limits of the region covered in this paper, they will all be treated in one section.

Cetacea (Whales and Porpoises)

A few species of Cetaceans are fairly well known on account of being the largest of living animals, and having been the object of the important commercial whale fishery for hundreds of years, as well as an important element in the food and fuel supply of certain of the Eskimo tribes from remote antiquity.

Lists of the Cetaceans found on any coast are difficult to compile for various reasons, including the amount of sea room allowed, or distance allowed from the shores in question. We find deplorable scarcity of authentic records except for the more important varieties. From the nature of their habits, sight records of the rarer species are uncertain, and the size of the animals prevents most specimens which are captured or stranded from being preserved or studied by competent observers. In more temperate regions, where there are no ice barriers, it may be safe to say that a certain species has been found in adjacent seas and an extralimital species may wander to the shores at any time. Peculiar ice conditions prevail east of the Canadian Arctic Archipelago, where the pack-ice opens early on the Greenland side and sets against the lands on the Canadian side until later in the summer. This may allow early migrating whales to approach the south and west Greenland shores in early summer and fail to reach the Canadian side at all. It is therefore unsafe to assume that a species recorded from south Greenland is entitled to a place in a Canadian list.

The Dominion Government expedition to Hudson bay and the Arctic islands, on board the C.G.S. *Neptune*, 1903-1904, was charged with collecting data on the whale fishery, and a good account was given by A. P. Low, Officer in Charge (1906). The whaling industry in these waters was then on a decline, and shortly after that date was practically finished.*

* In this paper the modern nomenclature is used, followed by a citation of the original description of each species, with the "Type Locality" or place where the specimen was obtained to form the basis of the description. The confusion in names has been largely due to insufficient material and many individual variations of one species due to age, etc., have been described as new species.

1. *Balaena mysticetus* Linnaeus. Bowhead or Greenland Whale

1758.—*Balaena mysticetus* Linnaeus, Syst. Nat., Ed. 10, Vol. I, p. 75. (Type locality.—Greenland seas).

The pursuit of the Bowhead was begun in Spitsbergen and Greenland waters over 300 years ago, and at times hundreds of sail, representing many nations, resorted to these waters. In spite of temporary revivals the industry shrank from scarcity of whales and the whalers sought other seas. Little whaling was done in the Canadian waters of Davis strait and Baffin bay until about one hundred years ago when the discoveries of the British explorers Ross and Parry disclosed the abundance of whales in these waters, leading to a rapid increase of the British whaling fleet, mostly fitted out from Hull, Dundee, Kirkcaldy, Peterhead, Fraserburgh, and Aberdeen, reaching a maximum in 1868 of thirty steam and sailing vessels (Low, 1906, p. 250).* After that time the numbers declined, although whaling ships frequented Baffin bay in small numbers until 1912. The United States whalers did not carry on Arctic whaling until 1846, and in 1860 began operating in Hudson bay, but after 1870 transferred most of their vessels to the Pacific coast, and by 1903 only one United States and one Scottish vessel were whaling in the bay.

In the early days of the whale fishery, whales were plentiful as far south as Marble island and northward to Repulse bay. Later fewer whales were taken in these southern waters and the whalers confined themselves to the southern shores of Southampton island and the waters of Roes Welcome. According to Low (1906, p. 257) the whales were known to enter Hudson strait as early as April, and in June and July were found along the land-floe on both sides of Roes Welcome, later proceeding to Repulse bay and through Frozen strait into Foxe channel. The northern and eastern parts of Foxe channel are too difficult to navigate on account of numerous shoals and reefs in the known parts, and continuous masses of ice, and these waters were the only portions of the bay where the whales were left undisturbed. Late in autumn the whales passed through Hudson strait going eastward. The migration in Davis strait began in March off Frobisher bay and Cumberland sound, crossing to the Greeenland side later and proceeding north to Melville bay, from whence they crossed to the western side of Baffin bay, sometimes being found in Jones sound and Lancaster sound in July and August, as well as in numbers at the mouth of Pond inlet. They reached Cumberland sound again in October, and remained along the edge of the new ice until December, after which their position until the next March is unknown. The growing scarcity of whales by 1903-04, may be indicated by the statement of Low that with an average whale producing about one ton of "whalebone" worth about $15,000 and twenty or thirty tons of oil valued at $100 per ton, the chase was becoming unprofitable, and the ships frequently returned empty. As the price of "whalebone" dropped almost to zero a few years later, and petroleum products had largely taken the place of whale oil, the whaling industry languished for some years and never revived for the now rare Bowheads. Sutton (1932, p. 89) gives notes on occasional whales killed by Eskimos around Southampton island since 1924, and states that he saw several during his stay in 1929-1930, and heard of a good many more. Later whaling developments have been in the capture of formerly ignored species, taken by shore factories in temperate zones and floating factories in the Antarctic regions, where whales are still numerous enough to be hunted profitably.

In primitive times, the Eskimos of some districts captured a few whales by lancing them from their skin boats, using the flesh for food, the oil for food

*The date following an author's name will enable the reader to find the complete bibliographic reference in the list of papers quoted at the end of this section (page 105).

and fuel, and the bones for making implements. During the heyday of the whaling industry, the white whalers employed considerable native assistance, and the natives became to a large extent dependent upon the whalers. After the whalers had gone, as well as most of the whales, the Eskimos occasionally captured whales with the gear left behind by the white whalers, but serious whaling operations have now practically ceased. Captain Henry Toke Munn (1932), who had a trading station at Pond Inlet in 1922, states that a large Greenland whale was driven into an ice lead by Killer Whales and shot by a native with a ·303 rifle. This whale yielded 1,600 pounds of bone and about twenty tons of oil.

The Bowhead feeds largely on small marine vertebrates, principally copepods, known as "whale food." At Pangnirtung, Baffin island, in 1928, I was told that the Bowhead was not hunted there any more but two had been seen near Kingua, near the head of Cumberland sound, during the white whale fishery. The natives said that "whale food" had been scarce for several years and the Bowhead is coming back because "whale food" is more abundant. Apparently on Ellesmere island, which is not now inhabited by Eskimos except those employed about the posts, there were formerly whale-hunting Eskimos, as bones of small whales form part of an ancient igloo ruin near the Royal Canadian Mounted Police detachment at Craig Harbour, and the late Inspector A. H. Joy gave me some bone implements he had excavated here, including a bunch of baleen.

2. *Balaenoptera physalus* (Linnaeus). Common Finback

1758—*Balaena physalus* Linnaeus, Syst. Nat., Ed. 10, Vol. 1, p. 75 (Type locality.—Spitsbergen seas).

Low (1906, p. 273) states that this species is found in Davis strait, chiefly on the cod-banks, where it devours immense numbers of fish. As it gives little oil and no valuable bone it was not killed by whalers in the north, and seldom by natives. Kumlien (1879, p. 66) observed it north of Hudson strait and about cape Mercy as well as on the Greenland coast. Sutton (1932, p. 91) gives Captain Comer as authority for the statement that this whale never comes into Hudson bay.

3. *Balaenoptera acutorostrata* Lacépède. Pike Whale, "Little Finner"

1804—*Balaenoptera acutorostrata* Lacépède, Hist. Nat. des Cétacées, p. p. xxxvii. (Type locality.—European seas).

Low (1906, p. 273) states that the "Little Finner" has the same range as the above, and that it is well known to the Eskimos of Greenland, but unknown to those of Baffin island.

4. *Sibbaldus musculus* (Linnaeus). Blue Whale, Sulphur-bottom

1758—*Balaena musculus* Linnaeus, Syst. Nat., Ed. 10, Vol. 1, p. 76. (Type locality.—firth of Forth, Scotland).

Low (1906, p. 273) who had good opportunities to interview some of the last of the northern whalers, states that this whale is usually confounded with the Finback Whale, has the same habits and is rarely killed by the natives.

5. *Megaptera nodosa* (Bonaterre). Humpback Whale.

1789—*Balaena nodosa* Bonaterre, Tabl. Encyclop. et Méthod Règnes Nature, Cétologie, p. 5. (Type locality.—coast of New England).

Kumlien (1879, p. 66) states that this whale was apparently not common in Cumberland sound at any season, and is little troubled by whalers in more southern waters. Low (1906, p. 273), states that it appears on the Greenland coast in summer, but has short whalebone of poor quality, and makes little oil in comparison to its size.

6. *Orcinus orca* (Linnaeus). Atlantic Killer Whale

1758—*Delphinus orca* Linnaeus, Syst. Nat., Ed. 10, Vol. 1, p. 77. (Type locality.—European Seas).

Kumlien (1879, p. 66) states that the Killer Whale is common in Cumberland Sound waters, arriving with the White Whale and following it up the fiords. Low (1906, p. 273) states that it is very voracious, living largely upon fish, seal, porpoise, and White Whale, and also attacking the Right Whale. For this reason it is much disliked by the whalers, as all other creatures flee when the Killer is around.

7. *Phocaena phocaena* (Linnaeus). Harbour Porpoise

1758—*Delphinus phocaena* Linnaeus, Syst. Nat., Ed. 10, Vol. 1, p. 77. (Type locality.—Swedish seas).

North Atlantic and North Pacific oceans; North sea; coast of Europe; Davis strait to 67° or 69° north latitude; coast of the United States, Maine to New Jersey; Alaska, Glacier bay; Puget Sound; Mexico, Banderas bay. (Miller, 1924, p. 513). Kumlien (1879, p. 66) says that this species was not rare in the southern part of Cumberland sound during spring and autumn, but he had no record from the upper end of the sound. Low (1906, p. 274) states that this porpoise arrives on the Greenland coast early in the spring, but does not go north of latitude 69° north, nor does it frequent the ice-laden seas of Baffin bay; also that it is unknown in Hudson strait and bay.

8. *Delphinapterus leucas* (Pallas). White Whale

1776—*Delphinus leucas* Pallas, Reise Russ. Reiches, Vol. 3, p. 85, footnote. (Type locality.—mouth of the Obi river, Siberia).

Arctic and sub-Arctic seas, north to 81° 35′, straggling southward to firth of Forth, Scotland, and cape Cod, Massachusetts (Miller, 1928, p. 514). The White Whale is in some disrepute along the north shore of the gulf of St. Lawrence, as it is alleged to injure the salmon fisheries, and government aid was obtained to attempt to drive away the whales, without much success. Farther north, it is prized by the Eskimos, particularly in certain localities where it enters bays in large schools, as in Frobisher bay, Cumberland sound, Hudson strait, Hudson bay, east branch of Mackenzie river, the "Whitefish Station" west of Mackenzie Delta, etc. It also occurs in numbers at times at Point Barrow and the mouth of the Yukon river, Alaska. Low (1906, pp. 274-275) states that many are killed annually by the natives along the south shore of Hudson strait, and that for several years successful fisheries had been made in the mouth of Koksoak river and in Leaf bay, in the southwest part of Ungava bay. Similar fisheries were formerly conducted in the mouths of Great and Little Whale rivers on the east side of Hudson bay, but after some success the whales would not enter these rivers over the nets, and the fisheries

were abandoned. Low also mentioned seeing great numbers of White Whales in the mouths of rivers to the northward of Little Whale river, notably in that of the Nastapoka. Soper (1928, pp. 74-75) mentions their occurrence in Lancaster sound, Prince Regent inlet; and that on the Canadian Arctic Expedition of 1923, hundreds were observed at Erebus bay, Beechey island, on August 17. The White Whale is used by the Eskimos for food and oil, and in the Mackenzie delta the meat is dried in large quantities, as well as buried in large pits for winter use. The inner part of the skin was also used to make boot soles and boat covers. During recent years the Hudson's Bay Company at Pangnirtung has been conducting an extensive White Whale fishery when the animals enter the upper fiords of Cumberland sound in July. When the whales come in, they are frightened to the heads of the fiords by motor boats, firing of rifles, and beating of pans. When the tide drops, the whales are stranded, and are shot and skinned, the skin and blubber being saved. In 1923, about 600 were killed, in 1924, about 800, and in 1925 large numbers were also secured. In 1928, I was informed at Pangnirtung, that the drive at Kingua fiord, 70 miles up Cumberland sound, had captured about 300, and about 160 barrels of oil were saved. Much of the oil was lost as it oozes out as soon as the whale is killed. The oil at that time was worth 65 cents to 70 cents per gallon. The skins were cut off in two pieces, salted and dried, but small skins were not marketable, as the manufacturers had no use for skins weighing less than 60 pounds salted and dried. Mr. J. H. Nichols, the agent who was in charge of the post which was operated at Port Leopold for one year, 1926-1927, informed me that the White Whales came in numbers on the east coast of Somerset island.

9. *Monodon monoceros* Linnaeus. Narwhal

1758—*Monodon monoceros* Linnaeus, Syst. Nat., Ed. 10, Vol. I, p. 75. (Type Locality.—Arctic seas).

Kumlien (1879, p. 67) reported the Narwhal as appearing regularly in spring and autumn in Cumberland sound, but Soper (1928, p. 76), records only two seen by an Eskimo on December 24, 1925, in an open tide-hole at the entrance to Pangnirtung fiord. In 1923 he saw the Narwhal only at Pond Inlet, where large numbers were seen moving along the coast on August 27-28; and a considerable number had been killed previous to August 21. William Duval, an old resident of Cumberland sound, told him that as many as 2,800 Narwhal have been taken in one year by whalers in and about Eclipse sound. Low (1906, pp. 275-276), states that the Narwhal prefers the proximity of ice, so that its summer range is more northern than that of the White Whale. The Narwhal appears to replace the White Whale in the waters of Pond inlet, and numbers are taken in the ice by the whalers of Baffin bay. The natives of Hudson strait kill numbers in early summer, and after the shore-ice has formed in the early winter, but none are seen on the south shore during the open waters of summer. It is found only in the northern waters of Hudson bay and is abundant in the icy waters of Foxe channel and Frozen strait. Inspector C. E. Wilcox, Royal Canadian Mounted Police, who was waiting for the ss. *Beothic* at Button point, Bylot island, (73° 05′ N., Long. 75° 13′ W.) on July 29, 1928, told the writer that Narwhal had been passing there in thousands during the past month, and that all the animals killed by the Eskimos had been females. While drifting in loose ice in Buchanan bay, 79° 10′ North, 74° 58′ 10″ West, we saw a few Narwhal during the night, and one came up about 85 yards from the ship. One female, measuring twelve feet in length, was killed in the early morning of August 3, and the skeleton preserved. One specimen was seen in Smith sound on August 7. At Nerke, Robertson bay, north Greenland, on August 8, we visited an Eskimo camp where we saw numbers of Narwhal bones,

and a large circular stone-walled meat cache about six feet high filled with half-dry meat, topped by slabs of Narwhal "*muktok*" or black skin. The flesh and skin of the Narwhal are eaten by the Eskimos as well as those of the White Whale. The long, spirally twisted horn which was probably the origin of the fabled Unicorn, is an overgrown incisor tooth projecting directly forward from one side of upper maxillary. It may measure over eight feet in length and weigh over fourteen pounds. It has a value as ivory, somewhat greater than walrus ivory.

Pinnipedia (Seals and Walruses)

10. *Phoca vitulina concolor* (DeKay). Atlantic Harbour Seal

1842—*Phoca concolor* DeKay, Zool. of New York, pt. 1, Mamm., p. 53. (Type locality.—Long Island Sound, near Sands Point, Queens county, N.Y.).

The Harbour Seal, or Ranger Seal, is more common in southern waters of the region, decreasing in numbers toward the north. Bay (1904, p. 477) lists the species occurring as far north as Ellesmere island. Kumlien (1879, p. 55) and Soper (1928, p. 39) considered the species rare in the Cumberland Sound region of Baffin island, and Sutton (1932, p. 37) states that while it is found in the waters all about Southampton island, especially near the mouths of the larger streams, and in the fresh-water lakes which are connected with the ocean, it is on the whole an uncommon animal. The skin of this seal is prized by the Eskimos for the fur-like quality and beauty of colour, and is used for fancy work and trimmings.

11. *Phoca hispida* Schreber. Ringed Seal

1775—*Phoca hispida* Schreber, Säugthiere, Vol. 3, p. 86. (Type locality. —coasts of Greenland and Labrador).

The Ringed Seal, Rough Seal, or Jar (the *Netsik* of the Eskimo) is the common seal of all the coasts of both Eastern Arctic and Western Arctic. Its flesh is the chief article of food of some of the Eskimo groups, and some groups subsist almost entirely on seal meat and blubber for months at a time. The dressed and dehaired skin is universally used for waterproof boots and kayak covers, and the haired skin for other garments, more so when the caribou are scarce. The blubber is the chief source of oil for the stove lamps which are used for cooking and heating purposes. Seals were formerly taken by harpooning, but now many are shot in the water, or while sunning themselves on the ice near their air holes. Seal nets are also used in some districts. The young are born under the snow beside an air hole in the ice and are covered with a coat of whitish woolly hair. The skins are purchased to some extent by the traders at a small price, but the main value of this species is for local use by the Eskimo inhabitants.

12. *Phoca groenlandica* Erxleben. Harp Seal, Saddle-Back or Greenland Seal

1877—*Phoca groenlandica* Erxleben, Syst. Regni Anim., Vol. 1, p. 588. (Type locality.—Greenland and Newfoundland).

The Greenland Seal is common on the Greenland coast at certain seasons, but the greatest congregation of the species is off the coasts of Newfoundland where the females give birth to their young on the floating ice of the Arctic ice pack. Large numbers are also taken in the gulf of St. Lawrence in the early spring. Farther north the species is more rare on the Cana-

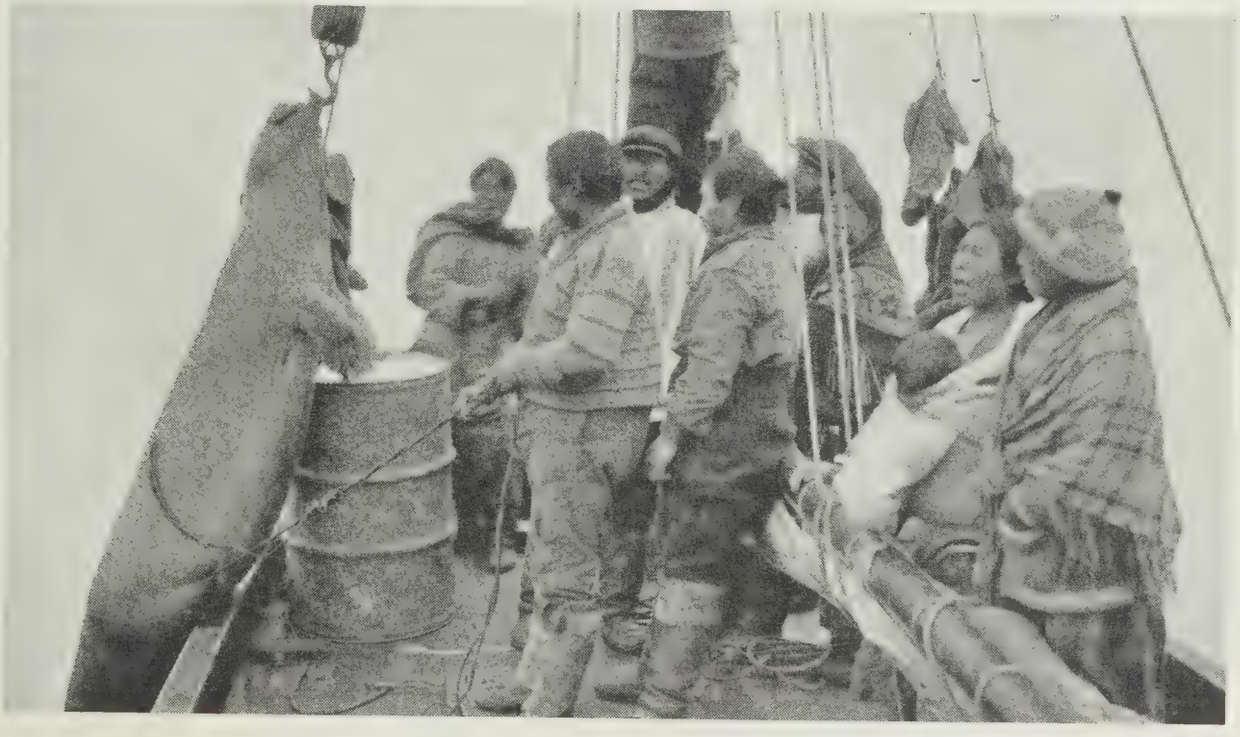
dian side, although reported very numerous at Port Burwell in June and July and in November and early December. Low (1906, pp. 279-280) states that in Hudson strait they are rare in summer, but are not uncommon after the shore-ice forms in the autumn, and before it leaves in the early summer; they are rare in Hudson bay, especially during the summer season, and are occasionally seen at other times. Sutton (1932, pp. 43-44), says that the Greenland Seal is one of the rarer species in the waters about Southampton island, being more definitely migratory, and is seen more commonly along the southern coast than along the Foxe Channel shore, or on Frozen strait or Duke of York bay. Soper (1928, p. 48) considers it one of the rarer species of the seas about Baffin island. On the 1928 Arctic Expendition, the writer was informed that the Greenland Seal came into the harbour at Clyde River, Baffin island, and one was shot at but lost on August 16, the day before we came in. At Dundas Harbour, Devon island, the species was reported as fairly common, and three were observed at Craig Harbour, Ellesmere island on August 10. Dr. L. D. Livingstone informed me that the Greenland Seal may be identified by its method of swimming, raising head and shoulders out of water and plunging straight forward. The Bearded Seal, as I have also noted in the Western Arctic, sticks his head straight up and goes ahead by thrusting head under, arching the back out of water in a curve. The swimming Ringed Seal, according to my observations, quietly settles down in the water and the head disappears without a splash. The late Captain E. Falk, Master of the ss. *Beothic* on the 1928 Arctic Expedition, who had been sealing in the same vessel during the spring of the same year, informed me that the 1928 catch (mostly in the eastern part of the gulf of St. Lawrence) was about 125,000 seals of a gross value of about $700,000, with skins worth about $3.50 each, the oil bringing somewhat more than the pelts. The blubber of the adult Harp Seal weighed about 200 pounds and pups ("white-coats") averaged about 40 pounds. The ss. *Beothic* captured 27,000 seals, the highest number for any one ship being about 34,000. Several years before this the ss. *Neptune,* famous also for Arctic expeditions as well as sealing during the past fifty years, had passed the record mark of over one million seals killed from this ship during her career. Shortly after this time, the sealing operations fell off, on account of overproduction of whale oil from the Antarctic. It is difficult to tell how much the Newfoundland sealing has depleted the seals, as modern methods have probably intensified the slaughter and covered up the depletion of the herds. The small number taken by local shore hunters on the north shore of the gulf of St. Lawrence, and a limited number taken by Eskimos constitutes the Canadian catch of this species.

Dr. Morten P. Porsild, Director of the Danish Arctic Station at Godhavn, Disko island, Greenland, told me in 1930 that Greenland Seal rarely come to South Greenland any more, as they have been killed off by the Newfoundland fishery. This has caused hardship to the Greenlanders who depended upon the seals for blubber, flesh, and skins. To replace the skins of seals, the Greenlanders now catch White Whales when possible. The range of the Greenland Seal extends east from Greenland to northern Siberia, and E. W. Nelson (1887, p. 263) reports obtaining a skin from cape Prince of Wales, Alaska, and seeing several while cruising in the pack ice around Wrangel and Herald islands in the summer of 1881. The only record of this species from the western Canadian Arctic is a specimen caught in a fishnet at Aklavik, west branch of Mackenzie delta, Northwest Territories, in 1924. Mr. A. E. Porsild saw part of the skin, and sent me a photograph of the animal taken by the Rev. Father Trocellier, of Aklavik. Presumably this lone individual came in through the open water route from the northwest, rather than through the archipelago to the eastward.

13. *Erignathus barbatus barbatus* (Erxleben). Bearded Seal

1777—*Phoca barbata* Erxleben, Syst. Regni Anim., Vol. 1, 590. (Type locality.—Coasts of Scotland, southern Greenland and Iceland).

The Bearded Seal, Big Seal, Ground Seal, or Square-flipper (*Ugruk, Ugjuk,* etc. of the Eskimos) is a circumpolar species which is fairly common on most of the coasts of this region. It is much valued by the Eskimos, being next in size to the walrus (up to about 800 pounds), as it provides a large amount of meat and blubber. The heavy hide is used for boot soles and covers of the large Eskimo umiak or skin boat, and is cut into heavy line which is used for dog-traces, harpoon lines, or strong lashings of any kind. As the Bearded Seal does not occur in large pods or schools, it is not taken in quantity, but enough are generally captured for local needs. The food consists almost entirely of crustaceans, mollusks, and the teeth are weak and rounded, less adapted for capturing fish than most other species of seals. On the 1928 expedition we observed the species as far north as Devon island and Smith sound. Kumlien and others state that the Bearded Seal dives to great depths, but Mr. James Throop, post manager for the Hudson's Bay Company at Clyde River, northeastern Baffin island informed me that the Bearded Seal is particularly common at that post, as the harbour has much shallow water. My own experience with the species in the Western Arctic, extending over several years, is that the Bearded Seal is more common around shoals and sunken reefs.



Seal Hunting
Eskimos hauling in bearded seal killed between Cape Smith and Cape Wolstenholme.

14. *Halichoerus grypus* (Fabricius). Grey Seal

1791—*Phoca grypus* Fabricius, Skrivter af Naturhist.-Selskabet, Kjøbenhavn, Vol. 1, pt. 2, p. 167, pl. 13, fig. 4. (Type locality.—Greenland).

The Grey Seal is a very large species, of plain colour pattern, found very rarely on the Atlantic coast from Nova Scotia to Greenland, but is more common in northern European waters. They are said to be largely pelagic and love to play in very rough water near rocks. Bangs (1910, pp. 458-468) states

that the species is rare along the Labrador coast. Dr. Robert Bell (1885, p. 520) stated that "skins of this seal were seen in the hands of the Eskimo in Hudson strait, and a large species known by the name is not uncommon along the Eastmain coast". The latter, however, may have been the Bearded Seal. We have no records to show its occurrence on the Canadian coast north of Hudson strait; and it is hoped that any future captures will be circumstantially reported, with description and measurements, substantiated with skin and skull if possible.

15. *Cystophora cristata* (Erxleben). Hooded Seal

1777—*Phoca cristata* Erxleben, Syst. Regni Anim., Vol. 1, p. 570. (Type locality.—Southern Greenland and Newfoundland).

The Hooded Seal, Crested Seal, or Bladdernose, is a fairly common seal of the north Atlantic and ranges over much of the same area as the Harp Seal. It is dark in colour, and the males have an inflatable bag of muscular tissue on top of the head. They are more pugnacious than the Harp Seal and more difficult to kill. The late Captain E. Falk informed me that the Hooded Seal is more common further south and about 15,000 were killed in the seal fishery of 1928. He stated that they were nearly exterminated several years before, as the mother seal does not leave her young and both are killed. For a long time there were two or three male seals after each female. The blubber of an adult Hooded Seal weighs about 400 pounds compared with 200 pounds for the Harp Seal. Low (1906, p. 280) states that the Hooded Seal is unknown to the natives of Hudson bay, and is an exceedingly rare visitor in Hudson strait. Kumlien (1879, p. 64) states that it is very rare in Cumberland sound, but a good many individuals were noticed among the pack-ice in Davis strait in July. Soper (1928, p. 48) did not observe it personally but reported one shot near Kekerten islands in the autumn of 1924. Low (1906, p. 280) stated that the Hooded Seal was common at Pond Inlet, but Dr. L. D. Livingstone told me in 1928 that he had seen only two at Pond Inlet, and Inspector A. H. Joy, who had wintered at Pond Inlet and at Craig Harbour, said he had seen one near Pond Inlet, but none farther north. However, at Pond Inlet we were informed that two had been killed there in 1927, and Constable Mackensen of the Bache Peninsula detachment, Royal Canadian Mounted Police, informed us that two were seen and killed by the Eskimos during the winter of 1927-1928 near cape Sabine, Ellesmere island. The species is apparently very rare that far north.

16. *Odobenus rosmarus* (Linnaeus). Atlantic Walrus

1758—*Phoca rosmarus* Linnaeus, Syst. Nat., Ed. 10, Vol. 1, p. 38. (Type locality.—Arctic regions. Ranges south to the coast of Labrador).

The Atlantic walrus was found as far south as the Magdalen islands in the gulf of St. Lawrence within historic times, and possibly as far as Sea Cow point on the north coast of Prince Edward Island, but has been gradually exterminated from the southern part of its former range, although Grenfell (1910, p. 362) reported one killed near cape Meccatina in the gulf the year before. Bangs (*ibid.*, 1910) stated that the walrus only reached south as far as Nachvak on the Labrador coast. Major L. T. Burwash, who has more recently studied the walrus situation, informed me in 1931, that the walrus has a very definite range, and at that time he did not know of any walrus south of Hudson strait. Low (1906, pp. 281-282) stated they were only killed rarely at cape Chidley the most northern part of the Labrador coast, while in Hudson bay they were formerly found as far south as Paint islands

on the east side of James bay, but that now (1906) they did not frequent that coast south of latitude 60° N., and their southern limit is about latitude 57° N., on the Belcher islands. He stated that there had been a rapid diminution in the number of walrus during the past few years since the Scottish steamer *Active* had been engaged in their capture (after 1898) and that under the methods of killing with only one in four or five of the animals killed being eventually secured, the walrus would soon be as rare as the Right Whale in Hudson bay. The commercial products of a large walrus being worth less than fifty dollars for oil, skin, and ivory, he considered that as the animal was of such importance for the subsistence of the Eskimos, it might be well to pass regulations reserving this animal wholly for the use of the Eskimos. Major Burwash states that the biggest walrus hauling ground in eastern North America was formerly at Padlei, northeast of Cumberland sound, Baffin island. One company took over 4,000 skins per year, and began to create a demand for walrus hides for lining of automobile tires. Walrus are still found in some numbers off Amadjuak bay, and are more numerous farther west, especially about King Charles cape, Mill, and Salisbury islands. They are also found along the east coast of Baffin island, but are scarce in Cumberland sound. Farther north they are more abundant in Lancaster sound, Jones sound, and Smith sound north to at least 80°.

A Walrus Herd
Walrus near Fury and Hecla Strait, 1933
(Courtesy Captain R. A. Bartlett)

During the 1928 Arctic Expedition, the writer made a special effort to trace the western limit of the range of the Atlantic walrus. Inspector C. E. Wilcox, Royal Canadian Mounted Police, make a patrol from Pond Inlet to Igloolik, Fury and Hecla strait (the narrow channel between Baffin island and Melville peninsula) in February, 1928, and found walrus in thousands at the edge of the floe in the northern end of Foxe basin, and smaller numbers in Fury and Hecla

strait. The natives there live largely on walrus and remain on the ice nearly ten months of the year. There is open water there all winter. At Bache Peninsula detachment walrus were common, and the *Beothic* party saw several while waiting in Buchanan bay; as well as about fifteen at Dundas Harbour on July 31. Mr. J. H. Nichols, who was stationed at the Hudson's Bay Company post at Port Leopold, Somerset island, in 1924-27, said that walrus were abundant on the east coast of Somerset island, but he saw none on the west coast, and no signs of any around Prince of Wales island, just west of Somerset island. Frank C. Hennessey (1910, p. 512) reported seeing a number of walrus as the ship lay near Browne island, and a single animal not far from Cornwallis island. J. G. McMillan (*ibid.*, p. 476) reported seeing walrus in Barrow strait the last week of August. Mr. A. J. Thom, who was stationed at Repulse bay for a time, informed the writer in 1928 that walrus are abundant in Repulse bay, but are not found in Committee bay (on west side of Melville peninsula), in Pelly bay nor on the coast of Boothia peninsula. He has been at all these places, and says that the Eskimos there get walrus ivory from Eskimos farther east for harness toggles, etc. Apparently the western limit of range of the Atlantic walrus in the south is Fury and Hecla strait, and in the north the upper part of Prince Regent inlet down to Bellot strait and the middle of Barrow strait, south of Cornwallis island.

Capt. Jos. F. Bernard, of the trading schooner *Teddy Bear,* informed me that natives told him they had seen a walrus in the water near a point on Lind island, south end of Victoria strait, near the southeastern angle of Victoria island, about 1914. These Eskimos had never seen walrus in these regions before, although they all knew of *Aivik* (=walrus) from their neighbours the Nechillek and Aivillek Eskimos to the eastward, who trade more or less ivory (walrus tusks) or ivory implements to the Eskimos west of them. Presumably this was an Atlantic walrus that had drifted through Bellot strait.

The Pacific walrus (*Odobenus divergens* Illiger (1815)) seldom goes east of Point Barrow, Alaska, but there are a few casual records of stragglers on the north coast of Alaska, one at Herschel island, Yukon Territory, and an old hearsay Eskimo record of a carcass stranded in Dolphin and Union strait some years prior to 1914. This extensive gap in the almost circumpolar range of the walrus is probably due to the difficulty of working through the ice-blocked channels of the Canadian Arctic archipelago; possible, also, to lack of proper walrus food in the intervening regions. The stomachs of walrus taken in Cumberland Sound region usually contain small elongated "clams" or mussels, principally (*Mytilus edulis*), which are also eaten by the natives there, either from the sea or from the opened paunches of walrus that have been killed.

We landed at Nerke, near Robertson bay, Greenland, August 7, 1928, and found two tents of Eskimos. The head of one of the families, a man named Mittek, had been killed by a walrus a few days before. He had gone out to hunt in his kayak as usual, and the battered kayak came ashore. Inspector Joy stated that the Etah (Greenland) Eskimos have no hesitation in attacking the ordinary walrus in a kayak, but are afraid of some individuals. He knew of one man who was injured in the head by the tusk of a walrus and had a tusk thrust through his shoulder. All persons in this region, white or native, have the greatest respect for the fighting ability of the walrus, which is considered the most dangerous beast in the country. The big bulls will attack a boat and not run away. When the walrus attack, the men want to have the boat near an ice pan where they can take refuge. Inspector Joy stated that the old hunting methods have generally become a lost art among the Baffin Island Eskimos, and only one or two of them would now attack a walrus with a kayak and harpoon, while the North Greenlanders do so as a matter of course.

The walrus has not generally been considered as preying upon other mammals, but Hantzsch (1913, p. 133) states that Cumberland Sound Eskimos informed him they had repeatedly seen walrus catch seals in the water, by embracing them and killing them, also that many times large pieces of seals were found in walrus stomachs. Matschie, in his introduction to Hantzsch's report (p. 149), states that this observation is so remarkable that one might not believe it, if such a scientific observer had not assumed the responsibility for it. Mr. A. E. Porsild later informed me that Greenland Eskimos say that walrus eat young seals, and that on two occasions in Greenland he saw young seals in walrus stomachs. Inspectors A. H. Joy and C. E. Wilcox both informed me of the belief of Pond Inlet Eskimos that walrus eat seals. Inspector Joy said that the Etah (North Greenland) Eskimos often fish for walrus at the edge of the floe by dangling a seal in the water. The walrus seizes the seal under its flipper and tries to take it down.

Walrus Protection.—By Order in Council, P.C. 1543, July 3, 1931, in the area including Hudson bay, Hudson strait and northward, no one may kill walrus except for food and not in excess of actual needs, and no one but an Eskimo may kill walrus without a licence. The export of walrus tusks or ivory, except in the shape of manufactured articles, is also prohibited except by permit from the Minister of Fisheries.

LAND MAMMALS

Ungulata (Hooved Mammals)

1. *Rangifer arcticus arcticus* (Richardson). Barren Ground Caribou

1829—*Cervus tarandus* var. *arcticus* Richardson, Fauna Boreali-Americana, Vol. 1, p. 241. (Type locality.—Fort Enterprise, District of Mackenzie, Northwest Territories.)

Caribou of the Barren Ground type are found in practically all parts of the region covered by this report. In this area the caribou is perhaps not quite as important a food animal as it is farther west, but the skin is everywhere in demand for winter clothing and bedding on account of its strength, lightness, and non-conducting of heat. Caribou meat is considered the best food produced in the country, and forms the bulk of the food consumed on the autumn hunts, and where possible some meat is also dried or frozen for winter consumption. Where the caribou have disappeared, the natives are usually poorly clothed, as nothing within the reach of the Eskimos is really a satisfactory substitute. The caribou are to some extent migratory, but the migrations are usually slow seasonal movements in search of grazing grounds, and a few caribou are apt to be found at any time of the year in any part of their range. The Barren Ground Caribou migrate northeast on the Melville peninsula and north to Boothia peninsula. The caribou of Baffin island do not seem to differ from those of the mainland, but it is not known whether there is any migration across from Melville peninsula to northern Baffin island.

2. *Rangifer arcticus pearyi* J. A. Allen. Polar Caribou

1902—*Rangifer pearyi* J. A. Allen. Bull. Am. Mus. Nat. Hist., Vol. 16, p. 409. Type locality.—Ellesmere island, latitude 79° North.)

The caribou of Ellesmere island and the Sverdrup islands belong to a small race, which is paler in colour than any of the more southern forms, sometimes nearly white in late winter and spring coat. The caribou of Devon island and some of the islands to the southwest of that region also appear to

be rather small and presumably belong to the same race, intergrading with typical *arcticus* of the mainland. Specimens of caribou from Devon, Cornwallis, Bathurst, Melville, Prince of Wales and Somerset islands and the northern part of Victoria island are needed before the relationship can be adequately worked out.

Musk-oxen, Cape Sparbo, Devon Island

3. *Ovibos moschatus moschatus* (Zimmermann). Musk-ox.

1780—*Bos moschatus* Zimmermann, Geogr. Geschichte, Vol. 2, p. 86. (Type locality.—Between Seal and Churchill rivers, Manitoba.) (=*Ovibos moschatus niphoecus* Elliott, Proc. Biol. Soc. Washington, Vol. 18, 1905, p. 135, type from head of Kazan river, District of Keewatin, N.W.T.).

The Musk-ox was formerly generally distributed over the Barren Ground area of the mainland and is still found on most of the islands north of the Canadian mainland with the exception of Baffin island, Bylot island, Somerset island and the islands in Hudson bay. We have no evidence that the Musk-ox now inhabits Melville peninsula, the only portion of the Arctic mainland included in this report, and we find no information in the accounts of the early explorers on this coast. However, the writer was informed by Captain Robert A. Bartlett that in the summer of 1933 he found musk-ox horns and parts of old musk-ox skulls at Lyon inlet and south of Fury and Hecla strait in old Eskimo village ruins considered to be not less than 200 years old. Eskimos frequently transport ladles and other artifacts of musk-ox horn considerable distances for trade purposes but are not apt to carry heavy, useless skulls any great distance, so the evidence of former occurrence of musk-oxen on Melville peninsula is good. Although no traces of musk-oxen have ever been found on Baffin island, their presence on the narrow land bridge of Melville peninsula up to Fury and Hecla strait increases the probability that further investiga-

tions on the northern part of Baffin island (Cockburn land) will demonstrate the former occurrence of musk-oxen there also. The Musk-ox formerly occurred at Repulse bay and according to Major Burwash a few still remain in the region north of Wager inlet and in the district between Committee bay and Rae strait. According to recent figures published by the writer (1930, pp. 49-51), there are only a few scattered bands left on the mainland of Canada, numbering not much more than 500 animals.

The Musk-ox of east Greenland has been described as a subspecies, the White-faced Musk-ox, *Ovibos moschatus wardi* Lydekker (Nature, Vol. 63, 1915, p. 157). Allen (1913, p. 198) assumes that all the musk-oxen of the Canadian Arctic islands belong to this form (*wardi*), but few if any specimens were available from other than Ellesmere and Melville islands, and many of these are scarcely distinguishable by the characters supposed to make the form. Specimens from Devon island show little difference from true *moschatus*.

The habit of the musk-ox in defending itself by coming to bay is effective against the wolf, its only natural enemy, but this habit is fatal when attacked by men and dogs, and the herd down to the last animal is easily slaughtered. The ordinary formation is that of making a straight or curving line with the old bulls on the flanks, and many good pictures have been taken of a small herd which has been kept under observation on the north coast of Devon island by occasional police patrols and visits by other Government expeditions. When we visited the place in 1928, there was only one Eskimo with one dog in the landing party, and only two musk-oxen were brought to bay. These two animals stood back to back for a long time with lowered heads, keeping off the dog by occasional short charges and nimbly jumping back to defensive position again. The extremely rapid rate of destruction of the species by Indians and Eskimos on the mainland and the danger from Eskimos, traders, and explorers farther north has induced the Government of Canada to attempt to preserve the remnant of the species (estimated at less than 13,000 in Canadian territory) by putting a total embargo on killing them.

Carnivora (Flesh-eaters)

4. *Thalarctos maritimus maritimus* (Phipps). Polar Bear

1774—*Ursus maritimus* Phipps, Voyage toward the North Pole, p. 185. (Type locality.—Spitsbergen.) (= *Thalassarctos maritimus* var. *ungavensis* Knottnerus-Meyer, 1908, type from Ungava bay; and *Thalassarctos labradorensis* Knottnerus-Meyer, 1908, type from Okak, Labrador.)

The Polar Bear, very appropriately called the Ice Bear by the Scandinavians, is a circumpolar species, and is found along all the coasts of the region. The Polar Bear feeds mainly on seals and spends most of the time on the sea ice, frequently drifting down the Labrador coast, and occasionally even to the gulf of St. Lawrence. It occurs in small numbers on Hudson bay and has been killed in James bay, but is becoming rather scarce south of Hudson strait. Farther north it is still fairly common and in northern Greenland and Ellesmere island may be called common. The skin of the Polar Bear has little commercial value except as a trophy, and while the flesh is eatable, the more southern groups of Eskimos hunt it only incidentally. In the Ellesmere Island-North Greenland area the bears are more numerous and are hunted more energetically by the Eskimos, furnishing an important source of food, while the skins are used for bedding and for making trousers and mittens. The old method of hunting was by bringing the bear to bay with dogs and killing the bear with short spears. While the Polar Bear farther south is generally rather shy, Inspector Joy states that west of Ellesmere island, where the bears have never seen men, they are not afraid and come right up to camp. He said that female bears are much easier to kill

as they do not fight with their paws. They merely throw the dogs away or snap at them. An old male bear fights deliberately and ferociously, striking with the forepaws and every blow kills a dog. Inspector Joy followed one bear track for about two miles in an absolutely straight line, when it turned at a right angle and went straight to a seal-hole. The hole was covered with heavily packed snow, which was very hard to dig through. He found that the bear had crushed down through the frozen snow and ice roof and got the seal. This shows a very keen scent and tremendous strength. It is almost impossible to build a bear-proof food cache. The writer once saw a looted blubber cache in a large oaken whale-oil tierce at Cape Parry, where the bear had broken the half-inch oak staves like kindling wood.

The Black Bear, *Ursus americanus* Pallas, is a forest species and probably never occurs in this region, but Bangsted (1931, p. 27) states that in the winter of 1921 Eskimos killed a Black Bear on the Barren Grounds, and the skin was obtained by the Hudson's Bay Company at Baker Lake.

Polar Bear

5. *Canis lycaon tundrarum* Miller. Tundra Wolf

1912—*Canis tundrarum* Miller, Smiths. Misc. Coll., Vol. 59, No. 15, p. 1. (Type locality.—Point Barrow, Alaska).

The Arctic Wolf is generally distributed throughout the whole region, and is most abundant in the districts where caribou are found. The wolves follow the caribou, and succeed in cutting out young, aged, sick, or wounded animals. Whether the wolves have any great effect upon the number of caribou in a region is problematical, as it is evident that where wolves are abundant, the caribou are likewise abundant. Where caribou are much hunted by man, however, the wolves may be an important factor in the decrease of caribou. The wolf is generally shy and hard to shoot or trap, but Inspector A. H. Joy

said that on Axel Heiberg island and on west coast of Ellesmere island the wolves were not timid and often came up to camp. He never saw more than five or six wolves together in the north, and saw only five wolves on Axel Heiberg island in his patrol of 1927. Where other game is scarce, a wolf will cause great annoyance by following a line of traps, stealing the baits and carrying off any foxes that happened to be in the traps.

The Arctic Wolf averages slightly smaller than the Timber Wolf of the interior. The wolves in the far north are usually whiter, often pure white. Further south the proportion of yellowish, tawny, or greyish specimens is greater. The pelts of the northern wolves have good fur in winter, and of recent years have brought a good price in the fur market.

6. *Alopex lagopus innuitus* (Merriam). Arctic Fox, White Fox, Blue Fox

1902—*Vulpes lagopus innuitus* Merriam, Proc. Biol. Soc., Washington, Vol. 15, p. 170. (Type locality.—Point Barrow, Alaska).

The White Fox and Blue Fox are merely colour phases of the same species, the blue phase being more common in Greenland, in some districts running almost equal to the white; and much rarer farther west, not more than one blue to five hundred or more whites in the western Canadian Arctic. While the White Fox of the northern mainland of Canada, Banks, Victoria, King William, and Baffin islands is referable to this form, the status of the foxes on the more northern islands is still undetermined. The White Fox is a noteworthy example of the effect of the demands of fashion upon the most remote tribes of Eskimos. Up to twenty-five years ago, the White Fox was not much regarded, and brought a small price. The first commercial exploitation was done by the whalers who hired Eskimos to hunt meat for them and help catch whales, others wanted seals and walrus oil or hides, and more recently, the leading product, and about the only one of much significance for the purchase of the "outside" foods, weapons, and other commodities which the Eskimos have been taught to desire, is the White Fox. In many districts this has changed the occupation of the people from hunting and fishing to trapping for fur and incidentally living to a large extent upon imported articles. A sudden drop in the price of "fancy" fur, or a diminution in the catch, then means actual hardship, though probably not as serious as the former cyclic or local famine periods, when there were no traders to tide the people over.

From the records of the fur trade, and other observers, it is known that the Arctic Fox has a period of abundance about every four years, coinciding approximately with the abundance of lemmings, which form a large part of the food of the foxes. A scarcity in the food supply causes most of the foxes to move to other districts and possibly die in large numbers. Fortunately, the White Fox is very prolific, bearing litters of ten or twelve, or even more young under favourable conditions, and soon regains its former numbers. Up to the present time, difficulties of transport and living conditions in the North have prevented the average trapper from operating there, and the untrapped territory has been able to keep up the supply of foxes in most districts.

The year 1928 was an "off year" for foxes, and I was informed that the lemmings had also nearly disappeared with the foxes, but the lemmings were now increasing again. In 1927-1928 only about 500 fox skins were traded from about 400 Eskimos in Cumberland Sound region, while in 1925-26 thousands were obtained from the same region.

7. *Alopex groenlandicus* (Bechstein). Greenland Fox

1799—*Canis groenlandicus* Bechstein, Pennant's allgem. Uebersicht vierfüss. Thiere, Vol. 1, p. 770. (Type locality.—Greenland).

This species of White Fox is very similar in general appearance to the Canadian species. The foxes of Ellesmere and Devon islands have been assumed to be the same as the Greenland form, but specimens of skins and skull, with measurements and weights, are needed to fully substantiate this.

8. *Vulpes fulva* (Desmarest). Red Fox

1820—*Canis fulva* Desmarest, Mammalogie, Vol. 1, p. 203. (Type locality.—Northeastern United States).

The Red Fox, in the normal red phase, as well as in the Cross, Silver and Black phases of the same species, is normally a dweller in wooded regions, but frequently ranges beyond the northern tree line. The larger, long-tailed Alaska Red Fox, *Vulpes alascensis alascensis* Merriam, commonly ranges east along the coast as far as Bathurst Inlet; and Preble (1902, p. 62) refers specimens from the west side of Hudson bay to *V. fulva*. Soper (1928, p. 33) gives information of five specimens, including one Black Fox, which have been taken on southern Baffin island, and Sutton (1932, p. 24) gives notes on two which were taken, and one observed by Eskimos on Southampton. These may have been either *fulva* which may have crossed to the islands from the mainland on the west side of Hudson bay, or the Labrador Red Fox (*Vulpes rubricosa bangsi*) which may have strayed there on drifting ice from the south side of Hudson strait.

9. *Lynx canadensis canadensis* Kerr. Canada Lynx

1792—*Lynx canadensis* Kerr, Anim. Kingd., Vol. 1, p. 187. (Type locality. —Eastern Canada).

The Canada Lynx is normally a forest inhabitant, but during or after the periodic shortage in the numbers of the Snowshoe Rabbit (*Lepus americanus*) the lynx often wanders far beyond the timber line. Soper (1928, p. 19) records one specimen taken at Lake Harbour, Baffin island, in 1918; one caught on Coats island, and one shot on ice-floes off Wakeham bay about the same time. The National Museum of Canada has one specimen taken on the ice of Franklin bay in 1917, and another taken the same year at Martin point, Alaska, which seems to indicate a general northward movement of lynx at that time.

10. *Mustela arctica arctica* (Merriam). Tundra Weasel, Ermine

1896—*Putorius arcticus* Merriam, North Amer. Fauna, No. 11, p. 15. (Type locality.—Point Barrow, Alaska).

The weasel or ermine of Arctic Canada and Alaska, as well as of Banks, Victoria, and Baffin islands has been referred to this form. While the species is widely distributed, there are few places in the northern regions where it is really common enough to be of great importance in the fur returns. Weasel skins in the white winter coat are difficult to determine specifically, and more specimens with skulls, preferably in the dark summer pelage, are much needed from the Arctic for scientific study of the different races.

11. *Mustela arctica semplei* Sutton and Hamilton. Southampton Island Weasel

1932—*Mustela arctica semplei* Sutton and Hamilton, Annals Carnegie Museum, Vol. 22, No. 12, pp. 79-81. (Type locality.—Coral inlet, South bay, Southampton island).

This new form is described as being considerably smaller than *M.a. arctica*, and said by the describer to have a closer affinity with the Greenland animal than with the variety found farther west.

12. *Mustela arctica polaris* (Barrett-Hamilton). Greenland Weasel

1904—*Putorius arcticus polaris* Barrett-Hamilton—Ann. and Mag. Nat. Hist., ser. 7, vol. 13, p. 393. (Type locality.—Hall land, Greenland, latitude 82° N., longitude 59° 20′ W.).

The Greenland Weasel is probably the form occurring in Ellesmere island, and possibly farther south, but in the absence of skulls and summer specimens it is impossible to come to definite conclusions as to the status of the weasels found north and west of Baffin island.

13. *Gulo luscus* (Linnaeus). Wolverine

1766—[*Ursus*], *luscus* Linnaeus, Syst. Nat., Ed. 12, Vol. 1, p. 71. (Type locality—Hudson bay).

The Wolverine, the largest species of the weasel family, is generally thought of as a forest animal but is a great wanderer, and stragglers have been recorded at unexpected distances to the northward of the limit of trees. The species has been recorded from Victoria, King William, and Melville islands, and it occurs fairly commonly in the region of Repulse bay. Soper (1928, pp. 32-33) was able to trace only a few casual records from southern Baffin island

Dead Wolverine

although a skin turns up at one or other of the trading posts every few years. Mr. James Throop told me in 1928 that no wolverine skins had ever been traded at Clyde River, but several have been taken within thirty miles of Pond Inlet. Dr. L. D. Livingstone, who has spent several years on Baffin island, says that wolverines are rather frequently taken at Pond Inlet, and I was informed that three were traded at Pond Inlet in 1927-1928. Some of these skins may have come from Fury and Hecla strait as the Eskimos there take many at Igloolik, and trade at Pond Inlet. The comparative scarcity of the Wolverine in the southern half of Baffin island, and the relative frequency at the northern end of the island, is good evidence that they come to Baffin island by way of Melville peninsula. The skin has no great value in the outside fur market, but is highly prized for hood trimmings in most parts of the Arctic, as frost does not readily stick to the soft glossy guard hairs.

Rodentia (Gnawing Animals)

14. *Citellus parryii parryii* (Richardson). Parry Ground Squirrel

1825—*Arctomys parryii* Richardson, Appendix to Parry's Second Voyage, p. 316. (Type locality—Five Hawser bay, Lyon inlet, Melville peninsula, Northwest Territories).

This species, known also as Arctic Ground Squirrel, or "marmot" (*Siksik* of the Eskimos), is found along the Arctic Coast and treeless region of Canada from Melville peninsula and Hudson bay to Bering sea, but is not known to occur on any islands except possibly a few small islands near the mainland. Dr. Kaj Birket-Smith (1933, p. 87) states that it occurs as far north as Fury and Hecla strait. This animal goes into hibernation from about October to May, varying some with local climatic conditions, and is most abundant where sandy soil thaws deeply enough to permit digging burrows. Where the frozen ground is covered with a non-conducting layer of tundra moss, the species is rare or absent. The *siksik* is of some importance as food in early summer after sealing has ceased and other game is scarce, and the skins are often used to make light and durable fur parkas.

15. *Lemmus trimucronatus trimucronatus* (Richardson). Brown Lemming

1825—*Arvicola trimucronatus* Richardson, Appendix to Parry's Second Voyage, p. 309. (Type locality.—Point lake, District of Mackenzie, Northwest Territories).

This species is fairly well distributed over the treeless area east of the Mackenzie river, and has been taken as far north as Banks island (Cape Kellett), southern Victoria island, Boothia peninsula, and Melville peninsula (Fury and Hecla strait). Allen and Copeland (1924, pp. 8-9) reported specimens from Cape Dorset and Soper (1928, pp. 49-55) found this species common in various parts of southern Baffin island. Sutton (1932, pp. 53-58) found it abundant on Southampton island, breeding throughout the year. There are few North American records of migration of lemmings in North America, but Captain J. Berthé, of Revillon Frères, told me that he saw a big migration of the Brown Lemming in May, 1926, at Baker Lake, and that he saw as many as one hundred dead at one time within one hundred yards of his house. The Brown Lemming may be distinguished from the fork-clawed species by not turning white in winter, the general colour being greyish or brown, with posterior portion of back usually bright hazel or chestnut in colour. The Brown Lemming usually inhabits meadows or marshy lands, while the other species prefers drier

land, usually higher and more rocky. All the lemmings fluctuate greatly in numbers, having a cycle of about four years, and are of great economic importance, forming the principal food of the foxes during periods of abundance. (See Elton, 1924, also page 62 of this report.)

16. *Dicrostonyx rubricatus richardsoni* (Merriam). Richardson Collared Lemming, Fork-Clawed Lemming, White Lemming (in winter)

1900—*Dicrostonyx richardsoni* Merriam, Proc. Biol. Soc. Washington, Vol. 2, p. 26. (Type locality.—Churchill, Manitoba).

The Collared Lemming has a greyish or brownish coat in summer, with usually a more or less distinct, narrow, black, median dorsal stripe, and a white coat in winter. The claws of the fore feet are much enlarged in winter and split at the end, so that the Eskimos say they have hoofs like a deer. Many Eskimos say that the summer and winter animals are different species, and that the white ones fall from the sky in winter. The belief is probably due to the fact that they work under the snow in winter, and when a strong blizzard sweeps the snow away, the lemmings are sometimes seen running around in a bewildered manner after a storm. This form (*richardsoni*) has its southeastern limit near Churchill, ranging west to Great Slave lake and Bathurst inlet; and northeast at least to Repulse bay. Sutton (1932) found *richardsoni* abundant on Southampton island. The late Mr. Georges Herodier, who spent many years in the Canadian Arctic, with Revillon Frères and later with the Hudson's Bay Company, told me that while crossing Queen Maud gulf from Perry river to King William island during first week in May, 1926, he saw great numbers of lemmings going north crossing the sea ice. They were grey lemmings, changing from the white winter pelage. Mr. Henry Bjorn, another employee of the Hudson's Bay Company, also reported to Mr. Herodier that he saw numbers of these lemmings in the same region during the third week in May. Mr. Herodier saw many lemmings dead in pools on the ice far from islands, 35 miles from land. These lemmings may have been either *richardsoni* or *groenlandicus* but probably the former. Arctic Hares and White Foxes were abundant the same year. In 1927 lemmings were very scarce; some seen on land, but none on the sea. Further observations on the abundance or scarcity of lemmings at any time, as well as their migrations, will be very desirable in our studies of the lemmings as well as other forms of life which depend upon them.

17. *Dicrostonyx groenlandicus* (Traill). Greenland Lemming

1823—*Mus groenlandicus* Traill, Scoresby's Journ. Voy. Northern Whalefishery, p. 416. (Type locality.—Jameson's land, Greenland.)

The Greenland Lemming is the form which seems to occur on Baffin island and all the larger islands north and west in the Canadian Arctic. It is known from various points in Baffin island, also Victoria, Banks, Melville, Borden, and Ellesmere islands, to North Greenland (Kane basin), and down to about 69° N. on the east coast of Greenland. No trace of it has been found in West Greenland south of Kane basin. The Greenland Lemming is smaller and more greyish than the more western forms, but its habits are similar.

The Barren Ground Meadow Mouse (*Microtus aphoredemus* Preble, 1902), which closely resembles the common short-tailed meadow mouse of more southern Canada, was described from specimens taken near Eskimo Point, on west side of Hudson bay, and is known to range on the Barren Grounds for some distance farther north. However, there are no records of any form of this group from any of the northern islands.

LAGOMORPHA (HARES)

18. *Lepus arcticus arcticus* Ross. ARCTIC HARE

1819—*Lepus arcticus* Ross, Voyage of Discovery, H.M.S. *Isabella* and *Alexander*, 8vo. ed., Vol. 2, app. 4, p. 151. (Type locality.—Southeast of cape Bowen, northeast coast of Baffin island.)

In general appearance the Arctic Hare resembles the White-tailed Jackrabbit (*Lepus townsendii campanius* Hollister) of the Canadian prairies, wearing a greyish coat in summer and white in winter, with black-tipped ears at all seasons, but is smaller than the jackrabbit, rarely weighing more than six or seven pounds. In most parts of its range the Arctic Hare is not numerous enough to be of great importance except as a life-saver in emergencies, but the flesh is relished when obtainable. The hare of northern Baffin island (Cape

YOUNG ARCTIC HARE, BOWMAN BAY, FOXE BASIN, BAFFIN ISLAND

Bowen and Pond Inlet region) is the typical form of the North American Arctic Hare, *Lepus arcticus* Ross. The hares of Southampton island were also referred to this form by Sutton and Hamilton (1932, pp. 71-79), and the late Dr. E. W. Nelson, who had made (1934) a revisionary study of the American Arctic Hare, concurred in this determination. J. D. Soper (1928, pp. 59-63) in studies made with the present writer, in the absence of actual specimens from northern Baffin island, referred the hares of southern and central Baffin island to the typical form on the basis of published descriptions and determinations by previous zoologists. Later, after specimens of hares from Pond Inlet had been sent to the National Museum of Canada by Inspector C. E. Wilcox, Royal Canadian Mounted Police, studies and measurements made by the writer showed slight but fairly constant differences between the Pond Inlet specimens and the Soper specimens, and recent examinations made by Dr. Nelson indicate that the specimens from southern Baffin island are distinctly nearer to Fort Chimo specimens (from south of Hudson strait)

than they are to those from either northern Baffin island or Southampton island, and are therefore more properly referable to the Labrador Arctic Hare (*Lepus arcticus labradorius* Miller).

It should be noted that no specimens of hares are available from an immense area in northern Baffin island from cape Bowen and Pond inlet down to Cumberland peninsula and the east side of Foxe basin. It is very desirable that future expeditions obtain specimens from Brodeur peninsula (northwestern Baffin island), Fury and Hecla strait, and Melville peninsula, in order to demonstrate the race of hares inhabiting that region. It may also be mentioned that while accounts of explorers give casual references to the presence of Arctic hares on most of the larger islands of the Canadian Arctic archipelago, there is still a large no-man's-land area from which no specimens are available in any museum.

Dr. E. W. Nelson's examinations of a large series of hares, including a large part of the pertinent material in museums of Ottawa, Washington, New York, Philadelphia, and Pittsburgh, showed that *L.a. labradorius* is the race occurring on the coast of the west side of Hudson bay, and he recently (1934, pp. 83-86) described the larger, darker-coloured hare of the Barren Grounds region as a new subspecies, *Lepus arcticus andersoni*, with type locality cape Barrow, Coronation gulf. The Barren Grounds Hare ranges in the Arctic drainage of the Mackenzie District, Northwest Territories, from Great Slave, Artillery, Aylmer, and Great Bear lakes to the Arctic coast, and west along the coast to Franklin bay, also in Victoria and Banks islands, and to an unknown distance on the mainland eastward of Coronation gulf. It is not yet known whether this large hare (well-marked in the dark summer coat) is found within the boundaries of the region covered by this report, but as no hares are known to be in any collections from the mainland north of Wager inlet, Boothia peninsula, King William, Prince of Wales, and Somerset islands, or the Parry islands (Melville, Bathurst, or Cornwallis) it is impossible at the present time to state which one of the various races of hares inhabits the inner circle of the Canadian Arctic archipelago. It is urgently desired that explorers of this region bring back more detailed information about the hares of the above region, particularly specimens, with weights and measurements. It is important to have dates on which the specimens are taken as it is known that the hares lose weight in winter and are much lighter in spring, building up during the summer. The maximum weight is probably attained between September and December. As some of the hares in the more northerly areas have an imperfect moult from the white winter coat into a darker summer coat, it is particularly desirable to have young hares up to eight or nine days old, and old ones taken somewhere between July 10 to August 20, so that they will be in the summer coat. As all these hares are white in winter, it is virtually impossible to make an identification of winter specimens except from geographical reasons, unless the skin is accompanied by the skull.

19. *Lepus arcticus labradorius* Miller. Labrador Arctic Hare

1899—*Lepus labradorius* Miller, Proc. Biol. Soc. Washington, Vol. 13, p. 39. (Type locality.—Fort Chimo, Ungava bay, Quebec.)

1902—*Lepus arcticus canus* Preble, North Amer. Fauna, No. 22, p. 59. (Hubbart point, west side of Hudson bay, Manitoba.)

The large series of Arctic hares from central and southern Baffin island in the National Museum of Canada collection were recently examined by Dr. E. W. Nelson and all specimens from south of Cumberland peninsula and east side of Foxe basin were referred to *Lepus arcticus labradorius*. This subspecies is also found on the coast of Labrador at least to Hamilton inlet, in the south side of Hudson strait and the east side of Hudson bay, as well as the west coast

of Hudson bay north to the Wager Inlet region. Its general habits are essentially the same as those of the Arctic hares, but more information is needed on the life histories of all the forms, particularly in the case of the more southern localities concerning the effect of longer summer season on period of moult.

20. *Lepus arcticus monstrabilis* Nelson. Ellesmere Island Hare

1934—*Lepus arcticus monstrabilis* Nelson, Proc. Biol. Soc. Washington, Vol. 47, pp. 83-86. (Type locality.—Buchanan bay, Ellesmere island, Northwest Territories.)

1896—*Lepus groenlandicus* Rhoads, Amer. Naturalist, Vol. 30, p. 236. (Type locality.—Robertson bay, northwestern Greenland.)

The hares of Ellesmere island and Devon island have until recently been considered to be the same as the form which is found along the western and northwestern coasts of Greenland (*Lepus groenlandicus*), and treated as a species distinct from the other Canadian Arctic hares. Dr. E. W. Nelson (1934) brought together a large series of Arctic hares from both Canada and Greenland, and showed that all the Arctic hares from Newfoundland northwest to Franklin bay and eastward including all of Greenland should be referred to one species, *Lepus arcticus*, of which *Lepus arcticus groenlandicus* is restricted to western and northwestern Greenland at least as far north as Humboldt glacier. The Ellesmere island hare is the largest of the hares of the farther northern region, attaining up to twelve pounds in weight, and adults are said to remain white throughout the year with small black ear-tips. This subspecies is further characterized by having the most marked extension of the premaxillae (anterior tip of upper jaw), and longest, most obliquely projecting upper incisors. It is found over all of Ellesmere island and Devon island, where the land is not covered by glaciers, probably also Axel Heiberg island, and Lancaster sound seems to be the dividing line between *monstrabilis* and true *arcticus*.

Hares are scarce on Devon island and are not very common in the Craig Harbour region of southern Ellesmere island, but the late Inspector A. H. Joy, Royal Canadian Mounted Police, told the writer that he had seen droves of hares on the west coast of Ellesmere island. Local abundance or scarcity of suitable food is probably the basic limiting factor for the hares, but the abundance of the species in some of the far northern localities is presumably due to the absence of human population.

Insectivora

21. *Sorex cinereus cinereus* Kerr. Common Long-tailed Shrew

1792—*Sorex cinereus* Kerr, Animal Kingdom, Vol. 1, page 206. (Type locality.—Severn Settlement, now Fort Severn, mouth of Severn river, southwest side of Hudson bay, Ontario.)

This tiny animal has one of the widest ranges of any Canadian species—from Nova Scotia to Ungava bay, west to British Columbia, and northwest to northern Alaska. While we have no actual specimens from the region covered by this list, the writer has taken specimens at several points on the Arctic coast east of the Mackenzie delta, and the National Museum of Canada has specimens from Coronation gulf and Churchill. Sutton and Hamilton (1932, p. 9) state that while the Eskimos did not know of the occurrence of shrews on Southampton island, natives from the Repulse Bay region knew the species well by the name "*Oogjeunuk*" (a name very similar to the name given to the shrew by Eskimos farther west—"*Ugrunak*" in northern Alaska and "*Ugyu-*

nak" in Mackenzie), and described the habits and appearance of the animal in detail. It is quite possible that the species may straggle into the Melville peninsula.

LAND MAMMALS OF SOUTH SIDE OF HUDSON STRAIT, EAST SIDE OF HUDSON BAY, AND SHORES OF JAMES BAY

Ungulata

1. *Rangifer arcticus caboti* G. M. Allen. Labrador Barren Ground Caribou

1914—*Rangifer arcticus caboti* G. M. Allen, Proc. New England Zool. Club, Vol. 4, p. 104. (Type locality.—Thirty miles north of Nachvak, eastern Labrador.)

This race of caribou closely resembles the Barren Ground type, but is said to have antlers with a more sweeping backward curve, and their tips carried farther forward; both brow and bez tines greatly developed. It is found in more or less scattered bands over the treeless Arctic Zone area and through parts of the scantily timbered Hudsonian Zone of the peninsula. In most of the districts near the coast they have been greatly reduced in numbers, but considerable numbers are still found in the more isolated inland districts, where difficulties of travel and the uncertainty of their migratory movements keep the hunters from making a clean sweep.

2. *Rangifer caribou caribou* (Gmelin). Eastern Woodland Caribou

1788—*Cervus tarandus caribou* Gmelin, Syst. Nat., Vol. 1, p. 177. (Type locality.—Eastern Canada.)

This large woodland species is found in the more open places of the heavily wooded parts of the Canadian Zone and the southern edge of the Hudsonian Zone. Both the small Barren Ground species and the larger Woodland species are said to be found on the east side of James bay, which is apparently the southern limit of the former and the northern limit of the latter. The Woodland Caribou of the eastern and southern end of James bay are presumably of the eastern race, but possibly caribou found west of James bay belong to the Western Woodland Caribou, *Rangifer caribou sylvestris* (Richardson), which was described in 1829, with type locality "Southwestern shores of Hudson bay."

The Woodland Caribou are shy animals, and do not thrive near civilization, but they are easily killed, and at the present time do not appear to be very common anywhere. Caribou from any part of this region are almost absent in collections, and it is very desirable that a few specimens be preserved in our museums for scientific study of the different races before it is too late to obtain them.

3. *Alces americana americana* (Clinton). Eastern Moose

1822—*Cervus americanus* (Clinton). Letters on Nat. Hist. and Int. Resources of New York, p. 193. (Type locality.—"Country north of Whitestown" (probably in the western Adirondack region, New York).

The Moose is fairly common in the wooded areas of the southern part of the region, but apparently does not occur north of the James Bay region. Corporal E. S. Covell, Royal Canadian Mounted Police, of Moose Factory, Ontario, reported in 1933 that many moose in the region south of James bay were suffering from some disease of the lungs and many were found dead.

4. *Odocoileus virginianus borealis* Miller. Northern White-tailed Deer.

1900—*Odocoileus virginianus borealis* Miller, Bull. N.Y. State Museum, Vol. 8, p. 83. (Type locality.—Bucksport, Hancock county, Maine).

The White-tailed Deer is neither an Arctic nor sub-Arctic species, but has been extending its range rapidly to the northward, and a specimen was taken in 1930 in Abitibi River district, within one hundred miles of James bay. Where the original forest is cut down or burned over the second growth provides more food for the deer.

Carnivora

5. *Thalarctos maritimus maritimus* (Phipps). Polar Bear.

The synonymy, distribution and other notes on this species have been given in the preceding notes on Eastern Arctic. It has been recorded in the past along all the seacoasts of this region.

6. *Ursus americanus americanus* Pallas. Black Bear

1780—*Ursus americanus* Pallas. Spicilegia zoologica, fasc. 4, p. 5. (Type locality.—Eastern North America).

The Black Bear is found more or less commonly in all the wooded parts of the region. Bell (1885, p. 51) states that he has seen the Black Bear as far north as Little Whale river, and was informed by the Eskimos that it occurred as far north as Okak on the Atlantic coast. Low (1888, pp. 77-78) states that it is found in small numbers on Charlton island in James bay. Strong (1930, p. 5) states that next to the caribou, the Black Bear is a very important food animal among the Naskapi Indians, and that in the spring and summer of 1927 four hunters of the Davis inlet band killed fourteen Black Bear, which was considered a smaller number than usual.

There have been many stories about some kind of grizzly or barren ground bear living in the interior of Labrador, but as these reports have been largely traditional and the district is so far from the ranges of any of the above species, it seems more probable that the legends may have referred to an odd specimen of the Black Bear in the brown or cinnamon phase. Further data will be welcomed.

7. *Canis lycaon lycaon* Schreber. Eastern Timber Wolf

1775—*Canis lycaon* Schreber, Säugthiere, p. 89. (Type locality.—Eastern Canada).

The wolf is generally distributed, being most common when caribou are abundant. Strong (1930, p. 7) states that the grey wolves are more common, but occasionally black or white animals are seen in the packs. The white animals may be due to sporadic albinism or to occasional straggling representatives of the Arctic Wolf from north of Hudson strait.

8. *Vulpes rubricosa bangsi* Merriam. Labrador Red Fox

1900—*Vulpes rubricosa bangsi* Merriam, Proc. Washington Acad. Sci., Vol. 2, p. 667. (Type locality.—strait of Belle Isle, Labrador).

The Labrador Red Fox is stated by Bangs (1910, p. 465) to be common throughout the whole of Labrador from the St. Lawrence to Hudson strait. However, this race is not very well differentiated, and little is known of its distribution in the interior, so that it is quite as probable that the red foxes east of Hudson bay and James bay should be classed with the common Eastern Red Fox, *Vulpes fulva*.

9. *Alopex lagopus ungava* (Merriam). Ungava White Fox

1902—*Vulpes lagopus ungava* Merriam, Proc. Biol. Soc. Washington, Vol. 15, p. 170. (Type locality.—Fort Chimo, Ungava bay, Quebec).

This subspecies is hardly to be distinguished from the White Fox of Northwestern Canada and the northern islands, but is said to be slightly larger than *A. l. innuitus,* with slightly different skull characters. It is generally abundant in the treeless districts, but comes farther south on the coasts, sometimes to the strait of Belle Isle on the east, and to the tip of James bay on the west, occasionally even to the north shore of the gulf of St. Lawrence. As the White Fox is a great traveller on the ice its numbers are probably augmented by stragglers from the west side of Hudson bay or the north of Hudson's strait.

10. *Martes americana americana* (Turton). American Marten

1806—*Mustela americana* Turton, Linnaeus, System of Nature, Vol. 1, p. 60. (Type locality.—Eastern North America).

11. *Martes americana brumalis* Bangs. Labrador Marten

1898—*Mustela brumalis* Bangs, Amer. Nat., Vol. 32, p. 502. (Type locality.—Okak, Labrador).

The typical Labrador Marten is a large dark form found in the humid coast districts from the strait of Belle Isle to the northern limit of trees. Bangs wrote in 1898 (p. 502) that from the lack of any intermediate specimens he felt justified in regarding *brumalis* as a distinct species, but as the marten, where not driven out by civilization, range from Southern Canada to the northern limit of trees, and are more or less variable in any district, it seems probable that there is a region of intergradation. The marten of the James Bay region are apparently nearer typical *americana.* Bangs wrote in 1898 (*ibid* 502) that "a complete series of good specimens from points all along the whole peninsula would be of the greatest interest, and is one of the things to be hoped for in the future, as martens are common all through the Labrador peninsula north to the tree limit." The same statement would apply with equal truth to any of the mammals of the whole peninsula, but unfortunately scientific mammal collecting in this interesting and comparatively unknown region has made little progress in the past thirty-six years.

12. *Martes pennanti pennanti* (Erxleben). Fisher

1777—(*Mustela*) *pennanti* Erxleben, Syst. Regni Anim., Vol. 1, p. 470. (Type locality.—Eastern Canada).

The Fisher is one of the most valuable fur-bearers, and has an extended range in the forested country from east to west in Canada, but a comparatively narrow north and south range, due to encroachments of civilization. It is not common anywhere. According to Low it rarely enters the southwestern limits of Labrador, not occurring east of Mingan nor north of Mistassini. Bell (1885) states that the Fisher is found around the southern end of James bay.

13. *Mustela cicognanii cicognanii* Bonaparte. Bonaparte Weasel

1838—*M*[*ustela*] *cicognanii* Bonaparte, Charlesworth's Mag. Nat. Hist., Vol. 2, p. 37. (Type locality.—Northeastern North America.)

The Bonaparte Weasel is common and generally distributed. It is the only small weasel with black-tipped tail, authentically recorded from this region, and a considerable series of skulls examined are all referable to this

BONAPARTE WEASEL (SUMMER AND WINTER)

(Drawing by Mr. C. E. Johnson, 1933)

form. Strong (1930, p. 7) states that the Naskapi Indian recognize three kinds of weasel in their territory, a large, an intermediate, and a very small weasel. The very small one may be the Least Weasel, which has been taken at Moosonee (Moose Factory), and the large one may be *Mustela arctica* straggling from across Hudson strait, or possibly an undescribed form. While the small weasels have some commercial value as "ermine" they do not usually bring a high enough price to bulk largely in the fur returns.

14. *Mustela rixosa rixosa* (Bangs). LEAST WEASEL

1896—*Putorius rixosa* Bangs, Proc. Biol. Soc. Washington, Vol. 10, p. 21. (Type locality.—Osler, Saskatchewan.)

The tiny Least Weasel, or mouse weasel, recognized by its small size, and very short tail without the black tip common to most other weasels, has been taken twice at Moosonee (Moose Factory) at south end of James bay, once at Fort Albany, and according to Strong (1930, p. 7) possibly also occurs in northeastern part of the peninsula. As the National Museum of Canada has one specimen of the Alleghenian Least Weasel, *Mustela rixosa allegheniensis* (Rhoads), taken by the late C. G. Harrold, at Natashkwan, Saguenay County, August 2, 1928, and one taken by the late Joseph Rochon at Ste. Veronique, Labelle County, Quebec, on September 3, 1927, it is quite possible that *M. r. allegeheniensis* is the form occurring in the Ungava peninsula and Labrador. It is slightly larger than *M. r. rixosa,* and darker (walnut-brown) in summer coat. The Least Weasel is probably more common and widely distributed than

generally supposed, because few scientific collectors work in the north country, and trappers who catch little weasels usually discard them as "kits" of the larger species, and too small to bring anything in the market.

15. *Mustela vison vison* Schreber. Eastern Canada Mink

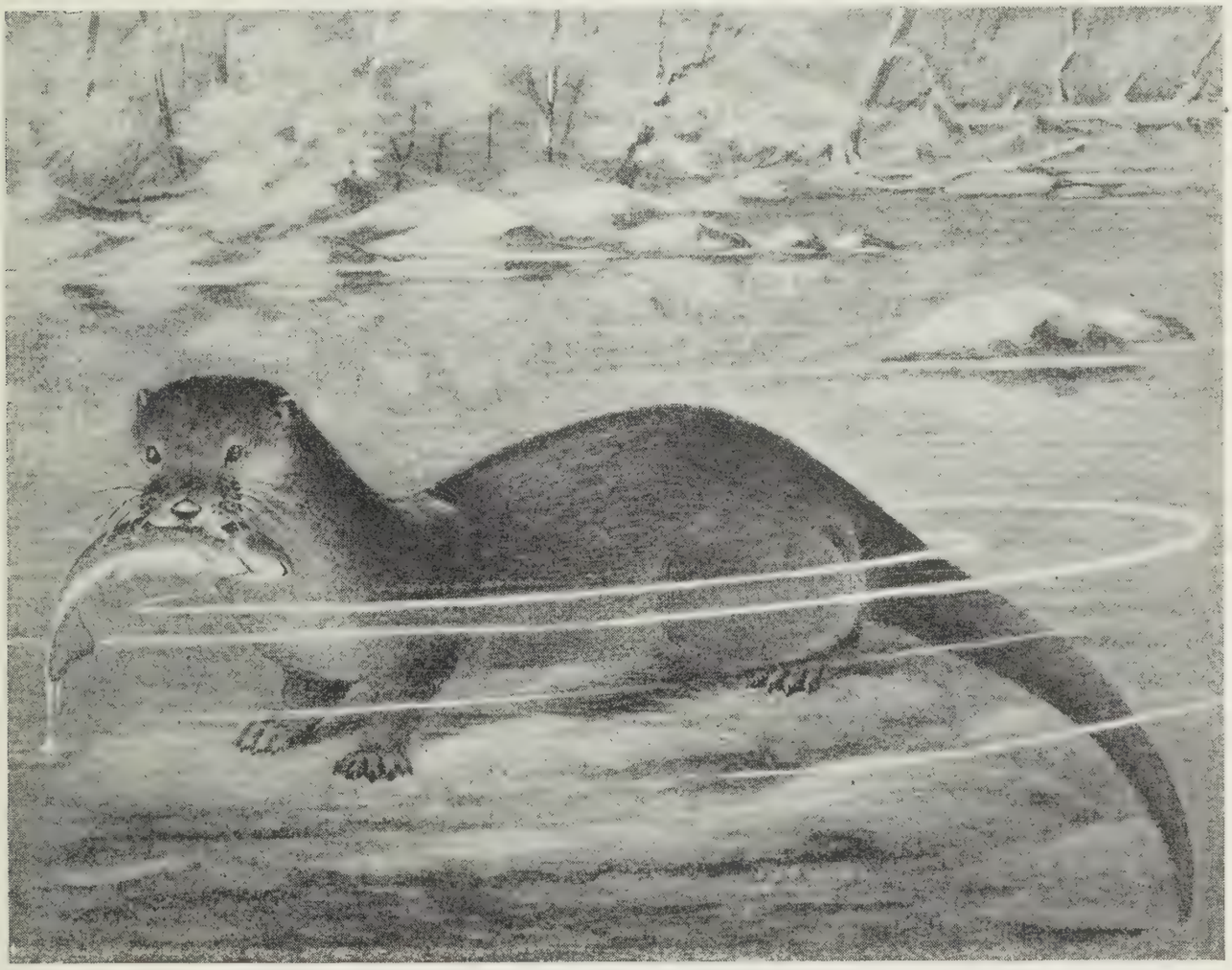
1777—*Mustela vison* Schreber, Säugthiere, p. 1276. (Type locality.—Eastern Canada.)

The mink is found through most of the wooded districts, being less common in the north. The Keewatin Mink, *M. v. lacustris* Preble, 1902 (Type locality, Echimamish river, Manitoba) is found on west side of Hudson bay and may possibly occur west of James bay, but there are no specimens available from that region.

16. *Gulo luscus* (Linnaeus). Wolverine

1766—[*Ursus*] *luscus* Linnaeus, Syst. Nat. Ed. 12, Vol. 1, p. 71. (Type locality.—Hudson bay.)

The Wolverine is common throughout the region, becoming more numerous to the northward.



Canada Land Otter

(Drawing by Mr. C. E. Johnson, 1932)

17. *Lutra canadensis canadensis* (Schreber). Canada Otter

1776—*Mustela lutra canadensis* Schreber, Säugthiere, pl. 126 b. (Type locality.—Eastern Canada.)

The Otter ranges throughout the wooded districts and north into the edge of the semi-barrens.

18. *Mephitis mephitis* (Schreber). Eastern Canada Skunk

1776—*Viverra mephitis* Schreber, Säugthiere, pl. 121. (Type locality.—Eastern Canada.)

The common skunk is said to be found occasionally on the north shore of the gulf of St. Lawrence, and Howell (1901, p. 23) records examination of specimens from lake Edward, Quebec, and Moosonee (Moose Factory), Ontario. Bell (1885, p. 50DD) states that it occurs on both sides of James bay, but is not very northerly in its range.

Rodentia

19. *Marmota monax canadensis* Kuhl. Canada Woodchuck

1777—[*Glis*] *canadensis* Erxleben, Syst. Regni. Anim., Vol. 1, p. 363. (Type locality.—"Canada et ad fretum Hudsonis.")

The common Canada Woodchuck has been recorded from Moose river and James bay, and along the west coast to York Factory, which is apparently its northern limit in this region.

20. *Marmota monax ignava* (Bangs). Labrador Woodchuck

1899—*Arctomys ignava* Bangs, Proc. New England Zool. Club, Vol. 1, p. 13. (Type locality.—Black bay, strait of Belle Isle, Labrador.)

The Labrador Woodchuck is a larger, darker animal than *canadensis*, and has been recorded from the strait of Belle Isle north to Hamilton inlet, but whether *canadensis* or *ignava* occur in the region between the strait of Belle Isle and James bay is not known.

21. *Citellus parryii parryii* (Richardson). Parry Ground Squirrel

1825—*Arctomys parryii* Richardson, Appendix to Parry's second Voyage, p. 316. (Type locality.—Five Hawser bay, Lyon inlet, Melville peninsula, N.W.T.)

The only known record of the Arctic Ground Squirrel in this region is one specimen, taken September 15, 1908, latitude 53° N., longitude 83° W., somewhere on the northwest coast of James bay, 70 miles south of cape Henrietta Maria. The specimen is typical of the species, but has caused some questioning as the locality is over five hundred miles southeast of Churchill, Manitoba, heretofore considered as near the southern limit of the species. It is hoped that future explorers along the little known strip of coast from York Factory, Manitoba, to the southern tip of James bay, will attempt to verify the occurrence of this species.

22. *Eutamias minimus borealis* (Allen). Northern Chipmunk

1877—*Tamias asiaticus borealis* Allen, Monogr. N. Amer. Rodentia, p. 793. (Type locality.—Fort Liard, Mackenzie District, N.W.T.)

The little Northern Chipmunk has been taken at Coral rapids, on the Abitibi river, less than 100 miles from James bay, and probably extends still farther north.

23. *Tamias striatus griseus* Mearns. Gray Chipmunk

1891—*Tamias striatus griseus* Mearns, Bull. Amer. Mus. Nat. Hist., Vol. 3, p. 231. (Type locality.—Fort Snelling, Minnesota.)

Howell (1929, p. 21) records one specimen from Mattagami lake and one specimen from James bay, the latter probably the specimen referred provis-

ionally to the Northeastern Chipmunk, *T. s. lysteri* by Preble (1902, p. 45). The writer has recently examined specimens of *griseus* taken by Eli Davis at Coral rapids, on lower Abitibi river, and the National Museum in 1931 received a specimen from Waswanipi lake.

24. *Sciurus hudsonicus hudsonicus* Erxleben. Hudson Bay Red Squirrel

1777—[*Sciurus vulgaris*] *hudsonicus* Erxleben, Syst. Regni Anim., Vol. 1, p. 416. (Type locality.—Hudson strait.)

The Hudson Bay Red Squirrel is common through the wooded region and has been taken in this region as far north as Fort Chimo. This species stores up food and comes out on pleasant winter days. The marten often feeds on the red squirrel and many trappers believe that the numbers of marten depend to some extent upon the numbers of squirrels.

25. *Glaucomys sabrinus sabrinus* (Shaw). Hudson Bay Flying Squirrel

1801—*Sciurus sabrinus* Shaw, Gen. Zool. Vol. 2, p. 157. (Type locality. —Severn river Northern Ontario.)

This species is known to range east as far as Godbout on the gulf of St. Lawrence, and thence west to south end of James bay, and along the west side of Hudson bay, in the wooded districts as far as Churchill. The flying squirrels are out in winter and where numerous are an annoyance to trappers on account of springing traps.

26. *Glaucomys sabrinus makkovikensis* (Sornborger). Labrador Flying Squirrel

1900—*Sciuropterus sabrinus makkovikensis* Sornborger, Ottawa Naturalist, Vol. 14, p. 48. (Type locality.—Makkovik, Labrador.)

The Labrador Flying Squirrel is larger and darker than any other Canadian species of the genus east of the Rocky mountains. Howell in his 1908 monograph of the flying squirrels stated that "There is no material to show what form occupies the interior of Quebec," and the condition holds to-day with this as well as several other northern Quebec and Labrador forms.

27. *Castor canadensis canadensis* Kuhl. Canadian Beaver

1820—*Castor canadensis* Kuhl. Beiträge z. Zoologie, p. 64. (Type locality.—Hudson bay.)

The beaver is common in the wooded districts where not trapped out, and ranges into the semi-barrens, wherever enough food can be found.

28. *Peromyscus maniculatus maniculatus* (Wagner). Hudsonian White-footed Mouse

1845—*Hesperomys maniculatus* Wagner, Wiegmann's Arch. f. Naturg., XI, Vol. 1, p. 148. (Type locality.—The Moravian Settlements in Labrador.)

This northern species of white-footed mouse does not appear to be confined to the woods and rocks to such an extent as most of its related species. At Port Burwell, near the eastern end of Hudson strait, many miles from the nearest timber, I found several holes in the ground along the path around the bay and by setting a few traps caught five specimens of this species together with two *Microtus pennsylvanicus labradorius*, on August 27-28, 1928.

29. *Synaptomys borealis innuitus* (True). Ungava Lemming Mouse

1894—*Mictomys innuitus* True, Proc. U.S. Nat. Mus., Vol. 17, p. 243. (Type locality.—Fort Chimo, Ungava Bay, Quebec.)

This rare subspecies of lemming mouse is known from a single specimen taken by Lucien M. Turner in the spring in 1884, but as little collecting of small mammals has been done in this region very little is known about its actual status. The lemming mice differ from the true lemmings in being much smaller, resembling field mice, but have broader skulls and very short tails, and the two upper incisor teeth are grooved in front. Naturalists in this region may add to our scanty knowledge of the small mammalian fauna by collecting specimens of all the small mouse-like species.

30. *Synaptomys borealis medioximus* Bangs. Labrador Lemming Mouse

1901—*Synatomys* (*Mictomys*) *medioximus* Bangs, Proc. New England Zool. Club, Vol. 2, p. 40. (Type locality.—L'Anse au Loup, strait of Belle Isle, Labrador.)

This subspecies is known from only two specimens, one from the type locality and one from Hamilton inlet. It is described as larger and brighter coloured than *S. b. innuitus*.

31. *Dicrostonyx hudsonius* (Pallas). Labrador Collared Lemming

1778—*Mus hudsonius* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 208. (Type locality.—Labrador.)

This is the only species of lemming found in the region south of Hudson strait. It is found throughout the barren grounds and treeless belts as far south as Hamilton inlet. It has some skull and tooth characters which distinguish it from the Arctic species, and is darker grey in the summer coat, with a rather indistinct blackish dorsal stripe. The winter coat is white as in other species of the genus.

32. *Phenacomys ungava ungava* Merriam. Ungava Phenacomys

1889—*Phenacomys ungava* Merriam, North Amer. Fauna, Vol. 2, p. 35. (Type locality.—Fort Chimo, Ungava bay, Quebec.)

This little animal is representative of several species and subspecies of a rare genus which is found in the colder zones and on mountains in Canada and the Western United States. It resembles the meadow mice very closely in general appearance and can hardly be distinguished with certainty without studying the distinctive skull and teeth characters. The few specimens in collections were confused with the meadow mice until 1889, when Dr. C. Hart Merriam discovered their radical differences, and put them in a new genus which he called *Phenacomys*, from which a rather awkward vernacular name False Lemming Mouse has been coined. There have been only a few straggling specimens of *P. ungava* taken at Chimo and Godbout in Quebec; Peninsula harbour on north shore of lake Superior, and Franz, Algoma District, Ontario. The fact that there is a wide gap of several hundred miles where no specimens have been taken is perhaps largely due to scarcity of collectors, but may be due to the species being very local in its distribution. It is interesting to note that the stomachs of four specimens of the Hawk Owl (*Surnia ulula caparoch*) collected by the Royal Ontario Museum of Zoology in northern Ontario (Abitibi river and Manitoulin District) all contained remains of skulls of *Phenacomys ungava*, but the human collectors were unable to find the species. Although a very inconspicuous species, *Phenacomys* probably play a part in providing a food supply for the smaller predatory mammals which go to make a large part of the fur production upon which the life of the bulk of the resident human population largely depends at the present time.

33. *Phenacomys ungava crassus* Bangs. Labrador Phenacomys

1900—*Phenacomys celatus crassus* Bangs, Proc. New England Zool. Club, Vol. 2, p. 39. (Type locality.—Rigolet, Hamilton inlet, Labrador.)

This is a somewhat larger and duller-coloured species of *Phenacomys* of which sixteen specimens are known from Hamilton inlet, Grosswater bay, and L'Anse au Loup. Considering what has been said of the preceding subspecies, it is impossible to state how far the range of this form may be found to extend after adequate collecting has been done in the region.

34. *Clethrionomys gapperi gapperi* (Vigors). Red-backed Mouse

1830—*Arvicola gapperi* Vigors, Zool. Journ., Vol. 5, p. 204. (Type locality.—Between York—now Toronto—and lake Simcoe, Ontario.)

The Red-backed Mouse is commonly found throughout the coniferous forest regions of Canada. The typical race is probably the form found in the James Bay region of both Quebec and Ontario. Two other races have been described from the Labrador and Hudson Strait region.

35. *Clethrionomys gapperi proteus* Bangs. Labrador Red-backed Mouse

1897—*Evotomys proteus* Bangs, Proc. Biol. Soc. Washington, Vol. 11, p. 137. (Type locality.—Hamilton inlet, Labrador.)

This form has more recently been reduced to subspecific rank, and has been taken at several points along the Labrador coast, in the normal red as well as in the dull brown and black (melanistic) phases.

36. *Clethrionomys gapperi ungava* (Bailey). Ungava Red-backed Mouse

1897—*Evotomys ungava* Bailey, Proc. Biol. Soc. Washington, Vol. 11, p. 136. (Type locality.—Fort Chimo, Ungava bay, Quebec.)

This Red-backed Mouse was reported to be abundant around Fort Chimo, and probably its range meets those of one or both of the two other forms somewhere in the interior of the peninsula, but much more extended and intensive collecting is necessary before much can be known about the range.

37. *Microtus pennsylvanicus labradorius* Bailey. Little Labrador Meadow Mouse

1898—*Microtus pennsylvanicus labradorius* Bailey. Proc. Biol. Soc. Washington, Vol. 12, p. 88). (Type locality.—Fort Chimo, Ungava bay, Quebec.)

This subspecies is considerably smaller than the meadow mouse of Eastern Canada, resembling *M.p. drummondi* of the west, but has more protruding upper incisors. The type was described from Fort Chimo, and we have specimens from Port Burwell, and several points on east side of Hudson bay. Farther south in the James Bay region it appears to intergrade with *M.p. fontigenus.*

38. *Microtus pennsylvanicus fontigenus* Bangs. Forest Meadow Mouse

1896—*Microtus fontigenus* Bangs. Proc. Biol. Soc. Washington, Vol. 10, p. 48. (Type locality.—Lake Edward, Quebec.)

The meadow mice found around the James Bay region seem to belong to *M. p. fontigenus,* intergrading to some extent with *labradorius. M. p. fontigenus* is not to be separated with certainty from *M. p. pennsylvanicus* of Southern Canada and Eastern United States, but is described as being smaller and darker in colour with skull lighter and more smooth.

39. *Microtus enixus* Bangs. Large Labrador Meadow Mouse

1896—*Microtus enixus* Bangs. Amer. Nat., Vol. 30, p. 105. (Type locality.—Hamilton inlet, Labrador.)

This species belongs to the large group of short-tailed meadow mice, field mice, or voles, which are common over most parts of temperate North America. It is slightly larger and duller and darker in colouration than the meadow mouse of Eastern Canada. It has been recorded from Hamilton inlet to Fort Chimo, Ungava bay, but we have no information about its distribution in the interior of the country. Cabot, in his book "In Northern Labrador," wrote an appendix on mice (1912, pp. 287-292) stating that the mouse of the Labrador barrens has an importance quite beyond its apparent insignificance, and that indirectly it is as important to the concerns of the Indians as the rabbit, both of which serve as the principal food of the fur-bearing mammals. They fluctuate violently in numbers and when mice are abundant, the fur-bearers increase, as well as the ptarmigan, which Cabot supposed are left alone when mice are plentiful and more easily caught. He also suggested that abundance of mice in certain districts, may also have an effect on caribou grazing and consequently on migrations. It is not exactly certain to which species of mouse Cabot referred, but the various voles and lemmings have similar habits and parallel fluctuations in numbers.

40. *Ondatra zibethica zibethica* (Linnaeus). Common Eastern Muskrat

1766—(*Castor*) *zibethicus* Linnaeus, Syst. Nat., Ed. 12, Vol. 1, p. 79. (Type locality.—Eastern Canada.)

The Common Eastern Muskrat is the race found around both sides of southern end of James bay, ranging from thence southeast to the St. Lawrence river. The limits of its range into the interior of the peninsula is unknown. A paler coloured race, the Hudson Bay Muskrat *O. z. albus* Sabine (Type locality, Cumberland House, Saskatchewan) is found on part of the west coast of Hudson bay, at least as far south as York Factory, but is not definitely known to occur as far east as James Bay coast.

41. *Ondatra zibethica aquilonia* (Bangs). Labrador Muskrat

1899—*Fiber zibethica aquilonius* Bangs, Proc. New England Zool. Club. Vol. 1, p. 11. (Type locality.—Rigolet, Hamilton inlet, Labrador.)

The Labrador Muskrat is described as a slightly brighter and more richly coloured form than the Common Eastern Muskrat, and has been recorded from the strait of Belle Isle to Fort Chimo. Hollister (1911, p. 20) wrote: "A large series of adult skulls and more skins in full winter pelage are much needed, and until these are available the validity of the form cannot be considered as satisfactorily determined." There is still a wide area from James bay to Chimo and the northeast end of the gulf of St. Lawrence where the muskrat is known to occur but no scientific specimens are yet available.

42. *Zapus hudsonius hudsonius* Zimmermann. Hudson Bay Jumping Mouse

1780—*Dipus hudsonius* Zimmermann, Geogr. Gesch., Vol. 2, p. 358. (Type locality.—Hudson bay.)

The Hudson Bay Jumping Mouse is found in this region as far north as James bay, and from thence northwestward to the Mackenzie river, but it is not known how far it extends to the northeastward of James bay. Although it ranges quite far north, this species is sensitive to cold and goes into hibernation comparatively early.

43. *Zapus hudsonius ladas* Bangs. Labrador Jumping Mouse

1899—*Zapus hudsonius ladas* Bangs, Proc. New England Zool. Club, Vol. 1, p. 10. (Type locality.—Rigolet, Hamilton inlet, Labrador.)

The Labrador Jumping Mouse, larger and darker coloured than typical *hudsonius*, is known to occur from Godbout on the north shore of the gulf of St. Lawrence, around the coast to Hamilton inlet, but we know nothing about its distribution in the interior, or where it meets or intergrades with *hudsonius*.

44. *Napaeozapus insignis abietorum* (Preble). Northern Woodland Jumping Mouse

1899—*Zapus* (*Napaeozapus*) *insignis abietorum* Preble, North Amer. Fauna, No. 15, p. 36. (Type locality.—Peninsula harbour, north shore of lake Superior, Ontario.)

This species is supposed to occur throughout the Hudsonian Zone in Eastern Canada, the most northern record being a specimen taken by Dr. A. P. Low at Hamilton river. The species is quite likely to occur in the interior. It may be known from the common jumping mice by its white-tipped tail and lack of premolar teeth.

45. *Erethizon dorsatum dorsatum* (Linnaeus). Eastern Canada Porcupine

1758—(*Hystrix*) *dorsata* Linnaeus, Syst. Nat., Ed. 10, Vol. 1, p. 57. (Type locality.—Eastern Canada.)

The common Eastern Canada Porcupine is probably the form found around James bay, as it is the race found in most parts of Ontario and western Quebec as far as known. Specimens from the James Bay region would be desirable to verify the range.

46. *Erethizon dorsatum picinum* Bangs. Labrador Porcupine

1900—*Erethizon dorsatum picinum* Bangs, Proc. New England Zool. Club, Vol. 2, p. 37. (Type locality.—L'Anse au Loup, strait of Belle Isle.)

According to Bangs (1910, p. 464) the Labrador Porcupine is common and generally distributed from the St. Lawrence north to the semi-barrens. The National Museum of Canada has one skull from Chimo, south of Ungava bay, but no skins. This subspecies is described as being larger than typical *dorsatum;* colour plain black or brownish black with very few whitish or yellowish tipped hairs except sparingly on rump and sides of tail.

Lagomorpha (Hares)

47. *Lepus arcticus labradorius* Miller. Labrador Arctic Hare

1899—*Lepus labradorius* Miller, Proc. Biol. Soc. Washington, Vol. 13, p. 39. (Type locality.—Fort Chimo, Ungava bay, Quebec.)

1902—*Lepus arcticus canus* Preble, North Amer. Fauna, No. 22, p. 59. (Type locality.—Hubbart point, west side of Hudson bay, Manitoba.)

The Labrador Arctic Hare is generally distributed over the barrens and semi-barrens of the peninsula, and is said to range as far south as Hamilton inlet (Bangs, 1910, p. 464) but the darker Newfoundland Hare, *L.a. bangsi* Rhoads, has been taken as far north as Davis Inlet, and may follow the Atlantic coast as far north as cape Chidley. Recent investigations show that *labradorius* also inhabits the coastal region of the west side of Hudson bay and the southern and central part of Baffin island.

48. *Lepus americanus americanus* Erxleben. Snowshoe Rabbit

1777—(*Lepus*) *americanus* Erxleben, Syst. Regni Anim., Vol. 1, p. 330. (Type locality.—Hudson bay.)

The Snowshoe Rabbit or American Varying Hare is found in all wooded or semi-wooded parts of the peninsula south of Hudson strait. As elsewhere,

it is of great direct importance as an article of food for the natives and indirectly as the principal food of some of the important fur-bearing mammals. The Snowshoe Rabbit is subject to periodic fluctuations in all parts of its range, the period of depression having an average occurrence of 9·6 years according to recent studies of historical data (Elton, 1933) and such a "crash" is invariably followed by a shortage of lynx, and nearly all other fur-bearers.

Insectivora (Moles and Shrews)

49. *Condylura cristata* (Linnaeus). Star-nosed Mole

1758—[*Sorex*] *cristatus* Linnaeus, Syst. Nat., Ed. 10, Vol. 1, p. 53. (Type locality.—Pennsylvania.)

Moles are not adapted for living either on rocky or frozen ground, but the Star-nosed Mole, the most northerly ranging species, has been recorded as far north as Eastmain river, James bay, Quebec; Moosonee, Ontario; and reaches its northern limit at Hamilton inlet, Labrador.

50. *Sorex cinereus cinereus* Kerr. Long-tailed Shrew

1792—*Sorex cinereus* Kerr, Anim. Kingd., Vol. 1, p. 206. (Type locality.—Fort Severn, mouth of Severn river, Hudson bay, Ontario.)

This widely-ranging species is found around James bay, up the east side of Hudson bay as far as Richmond gulf region (Seal lake), and north to Fort Chimo in Ungava.

The shrews are voracious little animals and in captivity have been known to eat more than three times their own weight in 24 hours. They are hardy animals and the writer has taken this species on the Arctic Coast east of the Mackenzie delta, and one running on top of the snow in the mountains of northern Alaska in February when the thermometer was lower than 40° F. below zero.

51. *Sorex cinereus miscix* Bangs. Labrador Long-tailed Shrew

1890—*Sorex personatus miscix* Bangs, Proc. New England Zool. Club, Vol. 1, p. 15. (Type locality.—Black bay, strait of Belle Isle, Labrador.)

This is a rather poorly defined subspecies of the long-tailed shrew, distinguished by somewhat larger size and with colour averaging slightly paler and greyer in winter pelage than typical *cinereus*. It has been taken at various points along the Labrador coast from the strait of Belle Isle north to latitude 58°.

52. *Microsorex hoyi intervectus* Jackson. Northern Pigmy Shrew

1925—*Microsorex hoyi intervectus* Jackson, Proc. Biol. Soc. Washington, Vol. 38, p. 125. (Type locality.—Lakewood, Oconto county, Wisconsin.)

The pigmy shrews are the smallest mammals known in North America, adult specimens seldom measuring more than 3·9 inches in total length from nose to tip of tail, the tail measuring about 1·4 inches. This is the only form of pigmy shrew known from the peninsula, and has been taken at Godbout and Fort Chimo.

(The American Saddle-backed Shrew, *Sorex arcticus arcticus* Kerr (1792) will probably be found to occur in this region. While there are no records of the species from the province of Quebec, it has been taken in Nova Scotia and New Brunswick, from which point there is a gap in the known range until central Ontario is reached. The type specimen was taken at Fort Severn, on west side of Hudson bay, and the species ranges northwest as far as Norman, on the Mackenzie river. Further collecting will probably demonstrate its

occurrence in intermediate regions. The Saddle-backed Shrew may be known by its tricolour pattern in all pelages—a blackish or blackish brown band along the middle of back, sides lighter and browner, and under parts paler and greyish.)

CHIROPTERA (BATS)

53. *Myotis lucifugus lucifugus* (LeConte). LITTLE BROWN BAT

1831—*Vespertilio lucifugus* LeConte, McMurtrie's Cuvier, Animal Kingdom, Vol. 1, p. 431. (Type locality.—Georgia; probably the LeConte plantation, near Riceboro, Liberty County.)

The Little Brown Bat is one of the hardiest of the bats, and ranges nearly to the limit of trees. In this region it has been recorded from Rupert House on the east side of James bay, Quebec, and bats seen by A. P. Low on Hamilton river and Mistassini probably belonged to this species. Bell (1885, p. 48DD) also reports seeing a small bat near Moosonee. Bats are rare in the north country, and any captured specimens should be preserved, as different species may perhaps occur.

REFERENCES

The earlier works on Arctic exploration usually have more or less extended notes on the larger mammals scattered through their text and a complete bibliographical list is beyond the space of this section. The following list includes the more important faunal papers on the district and a few shorter papers from which citations have been made:—

ALLEN, GLOVER M., and COPELAND, MANTON

1924—"Mammals from the Macmillan Expedition to Baffin Land." *Journal of Mammalogy,* Vol. 5, No. 1, February, 1924, pp. 7-12.

(Notes on a small collection taken in 1922 in vicinity of Cape Dorset and Bowdoin Harbour. Notes on six species.)

BANGS, OUTRAM

1898—"A List of the Mammals of Labrador," *The American Naturalist,* Vol. 32, July, 1898, pp. 489-507.

1910—"List of the Mammals of Labrador," Appendix IV, pp. 458-468, in Labrador, the Country and the People, by Wilfred T. Grenfell and others. New York, The Macmillan Co., 1910, pp. 495.

The late Mr. Bangs, while he did no field work in Labrador, amassed a large collection of Labrador mammals from various sources which was later obtained by the Museum of Comparative Zoology at Cambridge, Massachusetts, where Mr. Bangs became curator of birds. He listed 68 species, of which 17 are cetaceans, 7 pinnipeds, and 44 land mammals. He described several new mammals from the region in scientific periodicals, which are cited under the names in his 1910 list, and in the present publication.

BANGSTED, HELGE

1931—"Pattedyrlivet paa Barren Grounds" (Mammal Life on the Barren Grounds, notes from the Fifth Thule Expedition 1921-24). *Geografisk Tidsskrift,* Copenhagen, Vol. 34, No. 1, March, 1931, pp. 26-32.

(In Danish.) (Lists 19 species and gives brief notes on the same.)

BAY, EDVARD

1904—"Animal Life in King Oscar Land and the Neighbouring Lands," by Edvard Bay, Appendix III, in New Land, Vol. II, pp. 477-483, by Otto Sverdrup.

(Observations were made mostly on southern Ellesmere island and the Sverdrup islands, by the naturalist of the expedition. Seventeen species listed, of which 3 are cetaceans, 6 pinnipeds, and 8 land mammals.)

BELL, ROBERT

1885—Observations on the Geology, Mineralogy, Zoology and Botany of the Labrador coast, Hudson's strait and bay, by Robert Bell, M.D., LL.D., B.A.Sc., F.R.S.C. Geol. and Nat. Hist. Surv. of Canada, New Series, Vol. I. Montreal: Dawson Brothers. pp. 1D-62D.

Appendix II. List and Notes, by Dr. R. Bell, of "Mammals of the vicinity of Hudson's bay and Labrador," pp. 48DD-53DD. (Annotated list of 38 mammals, including pinnipeds, and 16 cetaceans.)

Bernier, Joseph E.

1909—Report on the Dominion Government Expedition to the Arctic islands and the Hudson strait on board the C.G.S. *Arctic* (1906-1907) by Captain J. E. Bernier Officer in Charge and Fishery Officer. Ottawa, pp. 127.

1910—Report on the Dominion of Canada Government Expedition to the Arctic islands and Hudson strait on board the D.G.S. *Arctic* (1908-1909) by Captain J. E. Bernier. Ottawa, pp. xxi, 529, map.

———Report on the Dominion Government Expedition to the Northern Waters and the Arctic Archipelago of the D.G.S. *Arctic* in 1910, under command of J. E. Bernier, Officer in Charge and Fishery Officer. Ottawa, pp. 161. [Not dated.]

(The above reports contain considerable information on whales, seals, walrus, and the larger land mammals.)

Birket-Smith, Kaj

1933—Geographical Notes on the Barren Grounds, by Kaj Birket-Smith. Report of the Fifth Thule Expedition, 1921-24, the Danish Expedition to Arctic North America in charge of Knud Rasmussen, Ph.D. Vol. 1, No. 4. Copenhagen, Gyldendalske Boghandel, Nordisk Forlag. pp. 128, ill. 45.

(Notes on "Fauna," pp. 83-93.)

Brooks, Allan, and Swarth, Harry S.

1925—A Distributional List of the Birds of British Columbia. Cooper Ornithological Club, Pacific Coast Avifauna No. 17. Contribution No. 423 from the Museum of Vertebrate Zoology of the University of California. Berkeley. pp. 158, ill.

(Plate II, "Map of Life Zones of British Columbia," important reference on Life Zones of North America.)

Cabot, William Brooks

1912—In Northern Labrador. By William B. Cabot. Boston, Richard G. Badger, The Gorham Press. pp. 292.

(Cabot gives accounts of several exploratory and hunting trips to northern Labrador, with many valuable notes on the natives and the animal life.)

Elton, Charles S.

1924—"Periodic Fluctuations in the Numbers of Animals: Their Causes and Effects," by C. S. Elton, Department of Zoology and Comparative Anatomy, The University Museum, Oxford. *The British Journal of Experimental Biology,* Vol. II, October, 1924. pp. 119-163.

1933A—Matamek Conference on Biological Cycles. Abstract of Papers and Discussions. Prepared by Charles Elton, M.A., Oxford University, in collaboration with the Editorial Committee of the Conference [1931]. Matamek Factory, Canadian Labrador, 1933. pp. 1-50.

1933B—"The Canadian Snowshoe Rabbit Enquiry, 1931-32," edited by Charles Elton, Bureau of Animal Population, Department of Zoology and Comparative Anatomy, Oxford University. *The Canadian Field-Naturalist,* Ottawa, Vol. 47, No. 4, April, 1933 (pp. 64-69), and No. 5, May, 1933 (pp. 84-86), with charts.

Hantzsch, Bernhard

1909—"Beiträge zur Kenntnis des nordöstlichsten Labradors" *Mitteilungen des Vereins für Erdkunde zu* Dresden, Vol. 8, pp. 168-229, 245-320. (Notes on the mammals, pp. 245-257; the whole article translated by M. B. A. Anderson and published in *The Canadian Field-Naturalist,* Vols. 45 and 46, 1931 and 1932, with annotations on the mammals by R. M. Anderson; 24 species of land mammals, 7 pinnipeds, and 22 cetaceans.)

1913—"Beobachtungen über die Säugetiere von Baffinsland," (Observations on the Mammals of Baffin's Land) with an introduction by P. Matschie. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin,* 1913, No. 2, pp. 141-160, Figs. 1-9. (Notes on 16 species.)

Hennessey, Frank C.

1910—Cruise of the Arctic, 1908-1909. By J. E. Bernier. Appendix. Report on birds, animals, crustaceans and flora, by F. Hennessey, pp. 502-513.

Hoare, W. H. B., and Anderson, R. M.

1930—Conserving Canada's Musk-oxen, being an account of an investigation of Thelon Game Sanctuary, 1928-29, with a brief history of the area and an outline of known facts regarding the musk-ox. By W. H. B. Hoare, Ottawa, pp. 53, Illustr., 1 map. Department of the Interior, Ottawa.

Appendix B. Notes on the Musk-ox and the Caribou, by R. M. Anderson, Ph.D. pp. 49-53, with maps of present distribution of musk-oxen and caribou.

HOLLISTER, NED

1911—A Systematic Synopsis of the Muskrats. North American Fauna, No. 32, U.S. Department of Agriculture, Bureau of Biological Survey, No. 32, Washington. pp. 38, pl. 7, 1 map.

HOWELL, ARTHUR H.

1929—Revision of the American Chipmunks (Genera Tamias and Eutamias). North American Fauna, No. 52, U.S. Department of Agriculture, Bureau of Biological Survey. Washington, pp. 157. pl. 2, figs. 9.

1901—Revision of the Skunks of the Genus Chincha, North American Fauna, No. 20, U.S. Department of Agriculture, Division of Biological Survey. Washington. pp. 45, pl. 8.

(Later revision of this genus gives priority to the generic name *Mephitis* Cuvier, 1800.)

KUMLIEN, LUDWIG

1879—Contributions to the Natural History of Arctic America, made in connection with the Howgate Polar Expedition, 1877-78, by Ludwig Kumlien, Naturalist of the Expedition. Department of the Interior, U.S. National Museum, Bulletin No. 15. Published under the direction of the Smithsonian Institution. Washington. pp. 179.

Mammals. Fragmentary notes on the Mammalia of Cumberland Sound, by Ludwig Kumlien. pp. 47-67. (Lists 21 species, including 7 cetaceans, 6 pinnipeds and 8 land mammals.)

LOW, A. P.

1889—Report on Exploration in James Bay and Country east of Hudson Bay, drained by the Big, Great Whale and Clearwater rivers, 1887 and 1888. By A. P. Low, B.Ap.Sc. pp. 1J-94J. Geol. and Nat. Hist. Surv. of Canada, Annual Report, New Series, Vol. III, Part 2, Reports H, J, K, M, N, R, S, T. Montreal, William Foster Brown & Co.

Appendix III: Notes on the breeding habits of certain mammals from personal observations and inquiries from Indians, by Mr. Miles Spencer, Fort George, Hudson Bay. pp. 77J-78J.

1906—Report on the Dominion Government Expedition to Hudson Bay and the Arctic Islands on board of the D.G.S. *Neptune*, 1903-1904. By A. P. Low, B.Sc., F.R.G.S., Officer in charge, Ottawa, Government Printing Bureau. pp. xvii, 355.

Chapters VI-VII, Eskimos, pp. 131-182, and Chapter X, Whaling, pp. 248-282, contain much information of the animal life and methods of hunting.

MERRIAM, C. HART

1889—Descriptions of fourteen new species and one new genus (*Phenacomys*) of North American Mammals, North American Fauna, No. 2, U.S. Department of Agriculture, Division of Ornithology and Mammalogy, Washington, pp. 35, pl. 8.

1893—Third Provisional Bio-Geographic Map of North America, Report of Division of Ornithology and Mammalogy, U.S. Department of Agriculture, Washington. (Plate I.)

1898—Life Zones and Crop Zones of the United States, by C. Hart Merriam, Chief, Biological Survey. Bulletin No. 10, U.S. Department of Agriculture, Division of Biological Survey. Washington: Government Printing Office. pp. 79; map, frontispiece, "Life Zones of the United States," corrected to December, 1897.

MERRIAM, C. HART, BAILEY, VERNON, NELSON, E. W., and PREBLE, E. A.

1910—U.S. Biological Survey, Fourth Provisional Zone Map of North America (in Check-List of North American Birds, prepared by a Committee of the American Ornithologists' Union. Third edition (revised). New York. (Frontispiece, map.)

MILLER, GERRIT S., Jr.

1924—List of North American Recent Mammals, 1923. By Gerrit S. Miller, Curator, Division of Mammals, U.S. National Museum, Smithsonian Institution, U.S. National Museum, Bulletin 128, Washington, pp. xvi, 674.

Lists 2,554 different forms of mammals recognized in North America north of Panama, including Greenland and the Greater and Lesser Antilles.

1932—Prairie Trails and Arctic By-ways, by Captain Henry Toke Munn. Hurst and Blackett, Ltd. London, pp. 299, illustr.

Captain Munn has had a varied experience in northern Canada, including Yukon mining, hunting musk-oxen on the Barren Grounds, and operating a trading post on northern Baffin Island.

NELSON, EDWARD W.

1887—Report upon Natural History Collections made in Alaska between the years 1877 and 1881 by Edward W. Nelson. Edited by Henry W. Henshaw. Prepared under the direction of the Chief Signal Officer. No. III. Arctic Series of Publications issued in connection with the Signal Service, U.S. Army. With 21 plates. Washington. Government Printing Office, pp. 337.

Part II, Mammals of Northern Alaska. By E. W. Nelson and F. W. True, pp. 227-293.

1909—The Rabbits of North America, North American Fauna, No. 29, U.S. Department of Agriculture, Bureau of Biological Survey, Washington, pp. 314, pls. 13, text figures and maps 19.

1934—"New Subspecies of the American Arctic Hare," by E. W. Nelson, Research Associate, Smithsonian Institution, Proceedings of the Biological Society of Washington, Vol. 47, pp. 83-86. March 8, 1934.

In this paper preliminary to a revision of the American Arctic Hares, Dr. Nelson, former Chief of the Biological Survey, U.S. Department of Agriculture, describes three new subspecies, *Lepus arcticus porsildi* from South Greenland, *L.a. monstrabilis* from Ellesmere Island, *L.a. andersoni* from Coronation gulf, and renames the East Greenland Hare, from Clavering island, as *L.a. persimilis*, the earlier name *Lepus variabilis hyperboreus* Pedersen (1930) being preoccupied by *Lepus hyperboreus* Pallas, Zoographia Rosso-Asiatica, Vol. I, 1831, applied to a species of *Ochotona* from eastern Siberia.

PREBLE, EDWARD A.

1902—A Biological Investigation of the Hudson Bay Region, North American Fauna, No. 22, U.S. Department of Agriculture, Division of Biological Survey, Washington, pp. 140, pl. 10, 1 map.

The Section on "Mammals of Keewatin," pp. 30-73, gives extended notes on 61 species.

1908—A Biological Investigation of the Athabaska-Mackenzie Region, North American Fauna, No. 27, U.S. Department of Agriculture, Bureau of Biological Survey, Washington, pp. 574, pl. 25, figs. 16, 1 map.

The section on "Mammals of the Athabaska-Mackenzie Region," pp. 126-251, gives extended notes on 103 species, including citations of most of the references to Arctic mammals in earlier literature.

RICHARDSON, JOHN

1829—Fauna Boreali-Americana; or the Zoology of the Northern Parts of British America: Containing Descriptions of the Objects of Natural History Collected on the Late Northern Land Expedition under Command of Captain Sir John Franklin, R.N., by John Richardson, M.D., F.R.S., F.L.S., etc., Surgeon and Naturalist to the Expedition, assisted by William Swainson, Esq., F.R.S., F.L.S., etc., and the Reverend William Kirby, M.A., F.R.S., F.L.S., etc. Part First containing the Quadrupeds, by John Richardson, London. (82 species of mammals listed.)

SETON, ERNEST THOMPSON

1925—Lives of Game Animals: An account of the land animals in America, north of the Mexican border, which are considered "Game," either because they have held the attention of sportsmen, or received the protection of law. Doubleday, Page & Co., Inc. Garden City, New York. 4 vols., profusely illustrated with photographs, original drawings, and maps showing distribution of species. pp. 640, 741, 780, 949.

SOPER, J. DEWEY

1928—A Faunal Investigation of Southern Baffin Island, National Museum of Canada, Bulletin No. 53, Biological Series, No. 15, Ottawa, pp. 143, pl. 7, 1 map.

Chapter II, Fauna. Mammals. pp. 28-76. Notes on 25 species, of which 6 are pinnipeds, and 8 cetaceans.

STRONG, WILLIAM DUNCAN

1930—"Notes on Mammals of the Labrador Interior," *Journal of Mammalogy*, Vol. II, No. 1, February, 1930, pp. 1-10.

(Dr. Strong accompanied the Rawson-Macmillan Sub-Arctic Expedition of the Field Museum as ethnologist, from June, 1927, to September, 1928, and spent some time in the interior with the Davis Inlet band of Nascapi Indians.)

SUTTON, GEORGE MIKSCH, and HAMILTON, WILLIAM J., JR.

1932—The Mammals of Southampton Island, Memoirs of the Carnegie Museum, Vol. XII, Part II, Section 1, Pittsburgh. Published by authority of the Board of Trustees of the Carnegie Institute, pp. 111, pl. 10, figs. 4.

(Notes on 16 species.)

ESKIMO OR HUSKY DOGS

ESKIMO DOGS, PORT HARRISON

Drawing shows a typical whip used by Eskimo dog drivers. The total length may vary from fifteen to thirty feet or more. The handle, which is made of wood or ivory, is about seven inches long.

Closely associated with the Eskimos, and in fact with all people wintering in the Arctic, is the Eskimo or Husky dog, the latter name apparently derived from the word "Huskie" or "Husky," used for many years past by people of the North as an alternative name for the Eskimo. These dogs are somewhat of a nuisance in the summer time and always somewhat of a problem in the matter of food, although those belonging to the Eskimos are allowed to forage for themselves in the summer months. Nevertheless, the welfare of the natives is so closely interlocked with that of their dogs that the latter are deserving of space in any publication describing conditions in Arctic and sub-Arctic regions. The following is extracted largely from a report on the Lake Harbour district of southern Baffin island, submitted to the Department of the Interior by its investigating officer, J. Dewey Soper. A Husky dog is a Husky dog no matter where he may be located and the description is fairly applicable to any area in the Eastern Arctic.

In some parts of the Arctic pure-blooded Eskimo dogs are now very rare. This is due to the fact that the white man, especially of recent years, has given considerable attention to increasing the size and strength of native dogs for draught purposes by cross-breeding with other types. This breeding has often been carried on in a rather indiscriminate way and although in some instances a faster or heavier type of dog has been developed, it is highly problematical if, for general purposes under Arctic conditions, any improvement has been achieved. Such cross-breeding has been more active in the Western Arctic than in the eastern regions. By some, the typical, pure-blooded Eskimo dog is regarded as being of a whitish-grey colour. The present-day dogs vary greatly in marking and colour from pure greyish-white to black; some are yellow, grey, or brown, and others bizarrely mottled.

The Eskimo dog is a sturdy animal of wolf-like appearance and characteristics, weighing from about 50 to 80 pounds. Weight varies greatly with individuals, and well-conditioned dogs may reach 90 to 100 pounds, or even more. In districts where walrus and seal are plentiful the dogs have a conspicuously better appearance than in areas where these sea mammals are hard to obtain. The average height at the shoulder is between 20 and 25 inches. On the whole the Eskimo dog has a powerful physique, with heavy neck and chest, and short, strong legs. During the winter the body is thickly covered with straight hair three or four inches long, with a dense underfur which permits the animals to withstand the rigours of the long Arctic winter. There is a mane-like growth of somewhat longer hair over the neck and shoulders. The muzzle is pointed, rather short and broad; the thick ears are small and pointed, and the eyes are wide-spread. The tail is thick and bushy, and in a state of health and vigour is held high and acutely curled over the hip. As a rule the drooping of the tail is an indication of sickness, indisposition, or fatigue.

During the season of winter travel the Eskimo dog lives principally on seal and walrus meat obtained by the native hunters. They will, however, eat meat of any kind, fresh or decomposed. The usual daily ration in winter travel consists of about 2 or 3 pounds of frozen seal or walrus meat per dog. Feeding time comes only in the evening. Under stress of circumstance, for relatively short journeys, half the above amount will suffice, or the animals may be fed a normal ration every other night. For continuous travelling, nightly feeding is usually the best. On the above diet Eskimo dogs maintain health and stamina in the coldest weather for trips of unremitting labour up to 1,000 miles or more. Periodical rest periods if not absolutely necessary are at least humane, and in the long run advisable.

During the winter the Eskimos are very solicitous for the welfare of their dogs and feed them with as punctilious regularity as conditions will permit. Summer is radically different; unaccustomed heat, flies, mosquitoes, and the necessity of shifting for themselves makes it in some respects the most trying time for Eskimo dogs. At this time no effort is made to feed them, though they secure small irregular quantities of offal and refuse about the settlements. The animals, therefore, singly or in bands, forage widely over the country in search of food on their own account. No doubt lemmings form a part of their diet at this time. But they more consistently follow the seacoast in search of shrimps, cast up animals, sculpins, and mussels, many of which are secured on the stony mud flats at low tide.

In hard times they will gluttonously consume almost anything that is available. As a result they are good hygienic agents in cleaning up about the Eskimo dwelling places. When they are very hungry, as the expression goes, " they will eat anything, down to a label from a tin can." It is said that dogs, though not averse to eating foxes, or even one another, will not often touch wolf flesh, or bear's liver; the latter frequently produces sickness and is usually thrown into the salt water by the Eskimos so that the dogs will not be able to get it. Skin lines, harness, skin clothing, and kayaks must be carefully kept beyond reach at all times. Hungry dogs are notoriously greedy thieves; caches of meat must be well guarded with piles of stones that their most strenuous labours will fail to move.

The endurance of Eskimo dogs is astounding and elicits the most unqualified admiration. In hardiness they surpass all other domestic animals, including the reindeer. They can endure the lowest temperatures and sleep out in the severest blizzards without shelter of any kind. In the lowest temperatures of mid-winter they contentedly curl up in the snow for the night in the most exposed positions with apparent indifference and enjoyment. Usually during

the progress of blizzards, with high winds and fine, drifting snow, however, they endeavour to find shelter in the lea of igloos, discarded snow blocks, or other objects. They can withstand starvation while undergoing strenuous exertions to a marked extent, and cases have been recorded of dog teams that have worked hard under severe conditions with little or no feed for several weeks. It is a common experience, while travelling, for dogs to go for several days destitute of food with no visible diminution of strength or spirits. This, of course, is never required of them except under stress of unavoidable circumstances.

In general disposition Eskimo dogs are reasonably affectionate. They reciprocate friendly attention, of which they appear to be somewhat jealous, in the usual canine fashion and do not often make any effort to bite a stranger, although with some dogs a lone stranger does run a risk, particularly if the dogs are hungry or if the stranger comes upon them suddenly. Cases have been reported of Eskimo dogs killing children, and in fact adults, but such occurrences are infrequent. Eskimo children may be seen daily playing amongst the swarms of dogs without any show of fear, but the parents do keep a rather close watch on the younger children. While they are puppies dogs are made pets of, which probably accounts to some extent at least for the comparative safety with which the children move about. Under ordinary circumstances if dogs become attentive to a troublesome degree it is sufficient to pick up a few stones and hurl one or two with sound intentions. Amongst themselves the dogs are very quarrelsome and fighting ensues at the slighest provocation. Usually one dog in each group fights his way to the top and bosses and bullies the rest. If he is a good dog he can enforce discipline in such a way that he will be especially valuable to his owner. On the other hand, his love of fighting may make him a nuisance. No matter how good a fighter a dog may be, he stands a good chance of not surviving the period of introduction as a new member of a team because he will probably have to take on all the rest of the team at the one time. If the owner wishes the new dog to become the "boss" of the team he usually supervises the introduction. The 20- to 35-foot dog whip is not only useful in directing the team, but its liberal use helps in preventing them seriously injuring one another in their free-for-all fights.

The Eskimo dogs suffer periodically from a disease closely resembling distemper, or the "fox encephalitis" found on fox farms in Canada and the United States.* In its more virulent form the death rate is very high, in many instances the majority of the dogs being killed off in the various communities. The disease is indicated by strange behaviour on the part of the dogs, which foam at the mouth and run about in a peculiar way, finally becoming weaker until they die. The whole problem of sledge dog epizootics has an extremely important bearing upon the economic life and welfare of the Eskimos, as well as upon the efficiency of white travellers in Arctic regions. During the past two years the matter has been given special study in the hope that the cause of the trouble may be ascertained and treatment prescribed. Further investigations are to be made next year. As a rule, as soon as a dog exhibits symptoms of serious disease it is shot and disposed of to prevent further contact with other animals.

Only under rather rare circumstances are Eskimo dogs afflicted with digestive complaints. Normally they are possessed of voracious appetites, invulnerable stomachs, active elimination, and cast-iron constitutions.

Dogs sometimes suffer a great deal from injuries to their feet in cold and hard travel, as particles of ice and snow collect under the nails and between the toes, resulting in cracks and sores. Under certain conditions of thaw, snow

* For a discussion of this subject see "Epidemics among Sledge Dogs in the Canadian Arctic and their Relation to Disease in the Arctic Fox", by Charles Elton, Can. Journal of Research, S. 673-692, 1931.

continually packs in little tubercles on the pads of the feet, which causes great temporary inconvenience and finally lameness; at such times the animals assidiously devote themselves on every halt to biting away the offending particles. They suffer most from feet trouble during spring travel. The snow is then soft in the day, but crusts with the colder temperatures of night; feet are softened with continual wetting and then scoured tender on the abrasive snow of morning and evening. During late spring with continual daylight and marked fluctuations of temperature in the twenty-four hours, travel is largely conducted at night. This season is the hardest on the feet of the dogs; the "candled" and sharply serrated suface of the sea ice, induced by the increasing warmth of the sun, causes cuts and bleeding of the tender soles. It is then necessary to provide some kind of footgear from skins, or pieces of canvas.

The female dog usually gives birth to from six to eight young, and litters may appear at any season of the year. If the mother is left to her own resources at such a time, she generally retires to a wild, secluded place. She is then usually crabbed and suspicious, and resents the presence of male animals; some of whom are not averse to disposing of the defenceless puppies in the absence of the mother. When the event takes place in the winter the Eskimos are quite solicitous about the mother and her pups, building a little snow kennel and covering the floor with old sacks, moss or heather, to keep the youngsters dry and warm. Their growth is rapid, and before a year old they have taken their place in the dog team—to serve faithfully as draught animals, often taking quite a share of punishment, until accident, disease, or old age marks the end of the long trail. Six or seven years is a good age for an Eskimo dog.

BIRDS OF THE EASTERN ARCTIC

By P. A. Taverner, National Museum of Canada, Department of Mines

The broad outlines of our knowledge of Canadian Arctic ornithology are derived primarily from observations made by the various historic expeditions for, and incidental to, the search for the Northwest Passage. Much of this work was done in the almost inaccessible interior of the archipelago and the data obtained still constitute a great part of our knowledge of that difficult area. These early investigations have been supplemented by various expeditions conducted under both private and public auspices, especially to the Eastern Arctic, particularly northern Ellesmere island and coasts adjacent to Baffin bay, Davis strait, and Hudson strait and bay. The difficulties of zoological research in high northern regions are great. The summer season of activity is short and, by travel conditions, limited to the immediate vicinity of expeditionary headquarters, which are located to meet more pressing needs than those of biological studies, and to more or less casual visits *en route* to and from other objectives. For various reasons too, few expeditions have been equipped with experienced ornithological specialists and the bird work has usually been done by amateurs or by officers with whom other exacting and vital duties took precedence. While the information thus gained has been of inestimable value to ornithology, and without it our knowledge of Arctic avifauna would be hazy indeed, it is often haphazard and sketchy and there are many details in which we have felt the lack of exactness and completeness that only experienced and systematically intensive study can produce.

The Canadian Government in its active administration of the Arctic areas has provided facilities for more systematic and intensive work. In addition to the earlier voyages of Low (1903-04) and of Bernier, (1908-09), both of which produced important ornithological results, and beginning with 1922 the Department of the Interior's annual patrol ship to the newly established Arctic administrative posts, as well as the posts themselves, have provided opportunities for research that were never presented before. It has been the policy of the Government to make these annual expeditions as productive of results as possible and no major expedition has sailed without a competent staff of scientific observers familiar with Arctic problems, and every opportunity to conduct investigation consistent with the major objects of the voyage has been given them. The posts themselves have been occupied by officials of intelligence some of whom have shown particular interest in the exploration of their surroundings and all have been sympathetically active in obtaining and transmitting particular information that has been desired. The posts have also offered station for various special investigators both for local intensive work and as way-points on long traverses and reconnaissances.

Advantage has been taken of all these new facilities and the information obtained has done much to increase and clarify our understanding of Arctic wild life. In 1923, J. D. Soper, representing the National Museum of Canada, accompanied the C.G.S. *Arctic* on her round trip, investigated points along the route and prospected for location for future work. In 1924, he returned on the same ship to Pangnirtung on Cumberland sound and spent two years investigating the life of southern Baffin island. From the post he made numerous trips along the coast and the following spring explored the Nettilling Lake region in the interior, finally making a traverse from thence to Amadjuak on Hudson strait and came out on the 1926 ship. This work has been reported

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upon in Bulletin 53 of the National Museum of Canada, 1928. In 1928-29 and 1930-31 he returned to southwestern Baffin island as special investigator for the Northwest Territories and Yukon Branch of the Department of the Interior, surveyed much of the Foxe peninsula and the east shore of Foxe basin, discovered the long-looked-for breeding grounds of the Blue Goose and made general ornithological investigations and collections. With the exception of a paper on the Blue Goose the report on this work has not been published but has been available to the writer in preparing the following list. In 1928, R. M. Anderson, and in 1929, P. A. Taverner, both of the National Museum of Canada, accompanied the patrol ship on her rounds, getting as far north as Bache peninsula, Ellesmere island and as far west as Beechey island. Chesterfield inlet in Hudson Bay was also visited. In 1930 Taverner spent the season at Churchill on the west side of Hudson bay, incidentally working his way up to Chesterfield inlet. There he more or less connected up with the valuable work that Geo. Miksch Sutton was coincidentally engaged in on Southampton island. A report on the latter has appeared in the Memoirs of the Carnegie Museum, 1932, and one on Churchill is in press.

The work of Bernhard Hantszch, 1906 and 1909-11, on the northern Labrador coast and southern Baffin island, where he died before completing his task, was most important. The results, published in German, were of limited distribution but thanks to M. B. A. and R. M. Anderson, who translated them into English, they have been made available and have been of great value in checking old information and correlating it with the new.

As we stand to-day, we have a fairly accurate knowledge of the birds of Hudson bay, of the islands at its mouth, and of eastern and southwestern Baffin island. We have a less detailed understanding of the east coast of the archipelago and its main entrances up to the northern part of Ellesmere island and must still rely on the old voyages for the great part of the interior of the archipelago. The western islands, Victoria and Banks have been investigated along their southern coasts by the Canadian Arctic Expedition of 1913-1918, the results of which have been available for the present report.

The areas of great desiderata now are the almost inaccessible ones of the Melville and Boothia peninsulas, the mainland expanse to the south of them and east of Great Slave lake and the islands northward in the heart of the archipelago. The difficulties and uncertainties of travel make these areas as yet very difficult of ornithological investigation. However, facilities are opening up for the study of the northern part of Baffin island and of Devon and Ellesmere islands. It is probable that the development of aeroplane transportation will do in the future the same for the more difficult localities. In the meantime it is well to point out that our knowledge of northern bird life is not by any means final and that any information that residents in or visitors to the Far North discover may be a valuable addition to scientific knowledge.

The following annotated list has been prepared to call attention to what we do not know as much as to present what has already been accomplished in order that those who have opportunity and inclination may more efficiently direct their energies towards the increase of knowledge of the birds of the north.

(The nomenclature used here is that of the American Ornithologists' Union Check List, Fourth Edition, 1930)

Loons

Red-throated Loon, *Gavia stellata,* is the common loon of the Arctic and a regular summer resident over the whole area south to the gulf of St. Lawrence.

Arctic or Black-throated Loon, *Gavia arctica*, is common in the southern Arctic but how far north of southern Baffin and Southampton islands and the western main coast it normally occurs is uncertain. The Pacific Loon, *G. a. pacifica* is the only form of the species in America. It migrates to the Pacific and is only accidental on the Atlantic Coast.

Common Loon, *Gavia immer*, does not seem commonly to extend north of Hudson strait and the western main coast. Many of the more northern records for the species may be misidentifications.

Yellow-billed Loon, *Gavia adamsi*, is confined to the Western Arctic, principally the main coast and adjoining mainland interior where it nests. It has been reported from the Boothia peninsula but certain information of occurrence to the east of Victoria or north of Banks island is lacking.

Grebes

But one Grebe has been authentically reported from the area:—

Horned Grebe, *Colymbus auritus*, occurs on James bay and some distance north along both shores of Hudson bay. A record for Ungava bay is doubtful as are the Hudson strait records for Holboell's Grebe, *Colymbus grisegena*.

Tube-nosed Swimmers

Fulmar, *Fulmarus glacialis*, is the commonest tube-nosed swimmer. It occurs all over Baffin bay and Davis strait. Seldom is a ship in these waters out of sight of one or many of these tireless fliers. The species nests in several colonies along the east Baffin island coast. It penetrates into the archipelago by way of Lancaster and Jones sounds and has been reported breeding on Melville island, but does not seem commonly to enter Hudson strait. It occurs in two colour phases, light and dark; the extreme dark phase being the scarcest, intermediates more numerous. All the Fulmars of the Canadian Arctic so far noted are the Atlantic Fulmar, *F. g. glacialis*, the Pacific form, not seeming to get east from Bering sea to the archipelago.

Sooty Shearwater, *Puffinus griseus* and Greater Shearwater, *Puffinus gravis*. The former has been reported by sight as far north as cape Chidley, the latter to Resolution island. Both breed only in the southern hemisphere and neither are regularly common so far north.

Wilson's Petrel, *Oceanites oceanicus*, has been reported by sight off Resolution island without any recent corroboration.

Storm Petrel, *Hydrobates pelagicus*, has been taken at the mouth of the Koksoak river, Ungava bay.

Leach's Petrel, *Oceanodroma leucorhoa*, which nests commonly along the southern Labrador coast can be expected farther north and possibly some of the Wilson's Petrel records above properly refer to this species.

Totipalmate Swimmers

Gannet, *Moris bassana*, has been reported in Davis strait north to latitude 65° but its occurrence there has not been verified by recent observers.

Two Cormorants have been reported from southeastern Baffin island:—

European Cormorant, *Phalacrocorax carbo*, breeds on the Greenland coast as far north as Disko island, and has been reported breeding on Cumberland sound and occurring off northern Labrador and Resolution island. Unfortunately no specimens seem to have been taken on the Canadian side

and the identifications are not beyond question. The only Cormorant definitely identifiable from the Canadian Arctic is the following:—

Double-crested Cormorant, *Phalacrocorax auritus*. Of this one specimen was obtained by Soper from Frobisher bay in 1930.

Swans, Geese, and Ducks

Whistling Swan, *Cygnus columbianus*, is probably of general distribution throughout the interior and western parts of the archipelago from Hudson bay and southwestern Baffin island to Melville island. It has not been reported adjacent to Baffin bay or Davis strait, though Soper thought he saw a flock at Pond Inlet.

Snow Goose, *Chen hyperborea*, is the commonest goose. It is distributed as breeder or migrant over practically all the Arctic, nesting on the low interior islands and only occasionally on the rugged coasts of Davis strait and Baffin bay. Two forms are known. The Greater Snow Goose, *Chen hyperborea atlantica* is an eastern race breeding to the north. Nestings of this subspecies have been demonstrated on Navy Board inlet, Eclipse Sound region and northwestern Greenland. The Lesser Snow Goose, *Chen hyperborea hyperborea*, breeds on southwestern Baffin island westward to Banks island and on the northwest main coast to Alaska. The subspecific identity of birds elsewhere in the archipelago is uncertain.

Canada Geese

Canada Goose, *Branta canadensis*, is probably the next most common goose. It is definitely known to breed northward to the southern parts of the lower tier of islands, southeastern Baffin island to southern Victoria island. Its extension northwards is uncertain but has been taken at Pond Inlet, northern Baffin island. Three forms occur within this territory. The large, Eastern Canada Goose or Honker, *B.c. canadensis* nests from southwestern Baffin island south to Newfoundland and southwestward to the Prairies and beyond. The middle-sized Lesser Canada Goose (the Hutchins's Goose of

previous authors) *B. c. leucopareia,* is more northerly, breeding from Southampton island westward, and the diminutive Richardson's Goose (the Hutchins's Goose of the 1930 A.O.U. Check-list, not the Hutchins's Goose of previous authors) *B. c. hutchinsi,* seems limited to southwestern Baffin island and Southampton island. Much more definite data on the distribution of these forms are desirable.

Brant or Brent Goose, *Branta bernicla,* is marine in its habits and is rarely seen away from salt water. It migrates along both outer coasts of the continent and breeds throughout the Arctic from southwestern Baffin island to Alaska northward to north Ellesmere island and down the Greenland coast. There are two races, the Eastern or American White-breasted Brant, *B. b. hrota,* of the Atlantic and the Black-breasted Brant, *B. b. nigricans,* of the Pacific. The two forms meet at Melville island but other points of contact are as yet undertermined.

Blue Goose, *Chen caerulescens,* is of the Eastern Arctic and mid-continental distribution. Late investigations have revealed that it nests on southwestern Baffin island and Southampton island, probably north to western Bylot island. It is only occasional on the east coast of Baffin island, migrates through the Mississippi valley via the east side at Hudson bay and Manitoba and is rare down the Atlantic coast.

White-fronted Goose, *Anser albifrons,* is a circumpolar species with an interesting discontinuous distribution. It is known to breed from the west coast of Greenland between latitudes 66° and 72° N., Iceland, Nova Zembla, the north coasts of Europe and Asia to Bering strait, and eastward along the North American main coast to Coronation gulf. It has not been reported in the Eastern Canadian Arctic or in the mid or western parts of the archipelago. There are two races of the species, a large and a slightly smaller one. The latter, *A. a. albifrons,* is the one most generally known. The former, the Tule Goose, *A. a. gambeli,* is known only from a limited number, wintering in California. Their migration route and particular breeding ground are yet to be discovered. Definite information as to the distribution of this species, especially that of its two races is greatly desired.

Ross's Goose, *Chen rossi,* like a very diminutive Snow Goose hardly larger than a large Mallard Duck, is still one of the enigmas of the north. Migrating through lakes Athabaska and Great Slave it disappears into the no-man's-land of the Northwest Territories. It may nest beyond the continental mass on Prince of Wales or Somerset islands or on the Melville peninsula and any data on it after it passes from well-known localities are desirable.

Barnacle Goose, *Branta leucopsis,* is a European species that has been taken once in the North American Arctic by Major L. T. Burwash near Cape Dorset, southwestern Baffin island.

River Ducks

Pintail, *Dafila acuta,* is the most common river or surface-feeding duck of the far north. In the Eastern Arctic it is fairly common only on Hudson bay north to Southampton island and has been taken at Chimo on Ungava bay and at cape Alberta, southwest Baffin island.

Green-winged Teal, *Nettion carolinense.* A record for Etah, Greenland, suggests the presence of this species at least occasionally in the Eastern Canadian Arctic, but the nearest places from which we have definite records of its occurrence are on James bay and at Churchill.

Sea or Diving Ducks

Most of the ducks of the Arctic belong to the hardy and robust sea or diving ducks.

Common Eider, *Somateria mollissima,* is the most numerous species. It breeds over the whole Eastern Arctic. Birds north of the mid Labrador are referable to the Northern Eider *S. m. borealis.* Westward it seems to extend through the northern islands to Melville island.

Pacific Eider, *Somateria v-nigra,* occurs along the northwest main coast to Dolphin and Union strait. Just where it replaces the previous species is uncertain.

King Eider, *Somateria spectabilis,* is a common and generally distributed species east and west, from the Labrador coast and Hudson bay to northern Ellesmere island.

Old Squaw, *Clangula hyemalis,* that occurs throughout the Arctic about as the previous species, is the next most important duck.

Harlequin Duck, *Histrionicus histrionicus,* breeds in northern Labrador and across the strait on Baffin island at least to Cumberland sound from which we have downy young. It has been reported from Etah, northwest Greenland, which suggests that it may occur in intervening territory. This species breeds on brawling mountain streams and is more at home on rock-bound coasts than any other species of duck.

American Goldeneye, *Glaucionetta clangula,* is to be expected only on waters adjacent to timber as at points on Hudson bay and off the Ungava peninsula.

Barrow's Goldeneye, *Glaucionetta islandica,* nests in northern Labrador, probably occurs regularly on Ungava bay, and may stray across the strait to southern Baffin island, though we have as yet no satisfactory evidence of its doing so.

Greater Scaup, *Nyroca marila,* has been taken on Southampton island but probably is more common on Ungava and Hudson bays.

Steller's Eider, *Polysticta stelleri,* is typically a Western Arctic species. There is an old sight record supported by convincing details from Cumberland sound. If there were not also corroborative specimens from Disko island, Greenland and the gulf of St. Lawrence, this Eastern Arctic record might not be taken seriously.

White-winged Scoter, *Melanitta deglandi,* Surf Scoter, *Melanitta perspicillata,* American Scoter, *Oidemia americana.* All three of these species have at one time or another been reported from Hudson strait where they probably occur more or less regularly as they do more commonly on Hudson bay.

Red-breasted Merganser, *Mergus serrator,* is the only merganser that fairly penetrates the Arctic. Soper found it generally distributed on southern Baffin island to the Cumberland peninsula. Though it has not been reported from Southampton island it is increasingly common farther south in Hudson bay.

Hooded Merganser, *Lophodytes cucullatus,* probably occurs some distance up the east side of Hudson bay as it does up the west side to Churchill. These are probably the nearest occurrences to Arctic territory.

Diurnal Raptores

Gyrfalcon, *Falco rusticolus,* is the characteristic hawk of the Arctic, and probably nests wherever there are sea cliffs adjacent to ample food supplies such as large rookeries of sea birds. It has been noted at various seasons all over the Arctic but is nowhere numerous. It shows a remarkable colour variation from largely pure white in the White-Gyrfalcon, *F. r. candicans,* through a grey form to the dark, heavily coloured Black Gyrfalcon, *F. r. obsoletus.* The relationship of these colour phases to each other and to their geographical breeding distribution is a subject upon which data is greatly desired. On present evidence the white form seems to predominate in the Eastern Arctic and the black one down the Labrador coast. The position of the grey birds is uncertain. Definitely ascertained breeding birds, if possible parents accompanied by well-grown young, are greatly to be desired.

Common Rough-legged Hawk, *Buteo lagopus,* seems to just touch the southern edge of the Arctic islands. In the east it has been noted as breeding in southwestern Baffin island, on Southampton island, the Melville peninsula, down the coasts of Hudson bay an indefinite distance and all the Labrador coast.

Grey Sea Eagle, *Haliaeetus albicilla,* is an Old World species extending to western Greenland. The only American record is a sight observation of a nesting at Kingua fiord, Cumberland sound. The species was not too well substantiated and the record has not been corroborated by recent observers. The fact that this is the most probable aquiline species for the locality retains it in our Arctic list though fresh evidence on the subject is greatly desired.

Golden Eagle, *Aquila chrysaetos* and Bald Eagle, *Haliaeetus leucocephalus,* have both occurred and are to be expected in the Hudson and Ungava bay districts.

Peregrine Falcon, *Falco peregrinus.* The American Peregrine Falcon or Duck Hawk is a breeder from well south of the Canadian-United States boundary northward throughout the southern islands to the Cumberland and the Boothia peninsulas.

Grouse

The two Ptarmigan are the characteristic and the only grouse of the true Arctic. Both species are at least partially migratory.

Rock Ptarmigan, *Lagopus rupestris,* the smaller of the two species is the most northern and most widely distributed through the Arctic of the two species. It is generally distributed from northern Ellesmere island southward to the mainland and both east and west. Two subspecies of Rock Ptarmigan can be recognized within the Arctic. The Southern Rock Ptarmigan, *L. r. rupestris,* in the interior of the Northwest Territories and the Ungava peninsula north to southern Baffin island; and the Northern Rock Ptarmigan, *L. r. kellogae,* characterized by more yellowish plumage in summer, occupying the rest of the Arctic islands and the northwestern main costal regions. Specimens of this species, particularly summer birds, are desiderata for study.

Willow Ptarmigan, *Lagopus lagopus,* is also generally distributed but has not been definitely reported from north of Lancaster sound or Melville island. It breeds further south than the Rock Ptarmigan, regularly to the bottom of Hudson bay while with the exception of those on Newfoundland, few *Rupestris* normally seem to nest below the shore of Hudson strait. It is to be noted that Willow Ptarmigan of the mainland, *L.l. lagopus,* have well blackened primary shafts; those of the islands, *L. l. leucopterus,* have their shafts white or much paler. (Illustrated on page 127.)

Spruce Partridge, *Canachites canadensis*, occurs wherever the timberline approaches the coast of Hudson and Ungava bays but it is not found under Arctic conditions.

Rock Ptarmigan on Nest

The rock ptarmigan is native to nearly all Arctic regions.

Marsh Birds

Sandhill Crane, *Grus canadensis*. The northern representative of this species, the Lesser Sandhill or Little Brown Crane, *G. c. canadensis*, is generally distributed over the southern tier of islands—Victoria and Southampton islands, and southern Baffin island. It is uncertain how far north it goes but we have seemingly good records for Bylot island and Boothia peninsula.

Whooping Crane, *Grus americana*. The original distribution of this rapidly disappearing species is now difficult to determine. We have circumstantial recent reports of it well up the west side of Hudson bay and an old one from near Pond Inlet. Though it does not seem possible that any one could mistake any other species for this strikingly distinctive bird its occurrence in the Arctic islands is surprising and can be regarded only as hypothetical.

Corn Crake, *Crex crex*. A wandering specimen of this Old World species was taken near cape Dorset, Baffin island, in 1928, the only record for the North American Arctic though it has been reported from southwestern Greenland.

Shore Birds

Lapwing, *Vanellus vanellus*. A casual specimen of this Old World species was taken on Cumberland sound in October, 1926. The following year was notable for an extraordinary and unique flight of Lapwings that was apparently storm-blown to the Newfoundland shores where they shortly after perished through inclemency of weather.

Semipalmated Plover, *Charadrius semipalmatus.* The most conspicuous and common plover. It is a common breeder over all the southern parts of the Arctic islands southward to James bay. Its northern limit seems to be southern Baffin island and the Boothia peninsula. Northward its place seems to be taken by the following species.

European Ringed Plover, *Charadrius hiaticula,* is so like the last named as to be inseparable without close examination in hand. Specimens from northern Baffin island are of this species and it has been reported from adjoining parts of northwestern Greenland. More data on the species and especially its westward extension are desirable. It has not been taken on the Atlantic coast of North America and it is evident that these Arctic occurrences are migrants from Europe.

Golden Plover and Newly Hatched Young

American Golden Plover, *Pluvialis dominica,* occurs through the centre and western parts of the archipelago east to western Baffin island and north to about latitude 75°. Rare on the bold and unsuitable eastern shores of Baffin and Ellesmere islands, it nests south well down the Hudson bay shores and on the barren ground interior, certainly in the Northwest Territories, and perhaps in Ungava.

Black-bellied Plover, *Squatarola squatarola,* is similarly distributed to the Golden Plover, but somewhat more northern in its breeding range. Northern records are from Somerset and Melville islands. It has not been reported breeding below Southampton island.

Turnstone, *Arenaria interpres,* is reported from nearly all the Arctic islands and as breeding from southern Baffin and Southampton islands to northern Ellesmere island.

Wilson's Snipe, *Capella delicata,* has been reported from Chimo and from cape Eskimo on the west side of Hudson bay. It probably occurs a similar distance up the east side of the bay or wherever the timberline approaches the coast.

Hudsonian Curlew, *Phaeopus hudsonicus,* has been demonstrated to nest in northern Alaska; Anderson river, Mackenzie district; on the west coast of Hudson bay; and on the west side of Southampton island. The only record north of this is an individual specimen from Admiralty inlet, northern Baffin island.

Eskimo Curlew, *Phaeopus borealis.* The original distribution of this nearly extinct bird is difficult to reconstruct to-day. Though it bred near the northwest main coast and probably did so on one or both sides of Hudson bay the only evidence of occurence in the Arctic islands is an old record for Cumberland sound.

Greater Yellowlegs, *Totanus melanoleucus,* occurs up the west side of Hudson bay and probably to the tree limit on the east side and to Ungava bay, but the only record under truly Arctic conditions is for Cumberland sound in 1877, where it has not been noted since.

Knot, *Calidris canutus,* is well distributed through the interior of the archipelago to northern Ellesmere island. There are breeding records for the latter and for southeastern Victoria island, and it has been noted under probable breeding conditions on Melville island. It seems to be a migrant only on Southampton and southwestern Baffin islands.

Purple Sandpiper, *Arquatella maritima,* is a species more at home on rugged, rock-bound seacoasts than on low, tidal flats. Though generally distributed through the eastern and central Arctic islands to extreme north Ellesmere island, actual breeding evidences are few. Semi-downy young have been taken on Southampton island and eggs on southwestern Baffin island and on Melville bay, Greenland. Kumlien suspected that it bred on Cumberland sound.

Pectoral Sandpiper, *Pisobia melanotos.* Arctic records of this common species are surprisingly few. It has occurred in western Greenland and has been found breeding on Southampton and Victoria islands. It seems only a migrant on Hudson bay. Other evidences of Arctic occupation are lacking.

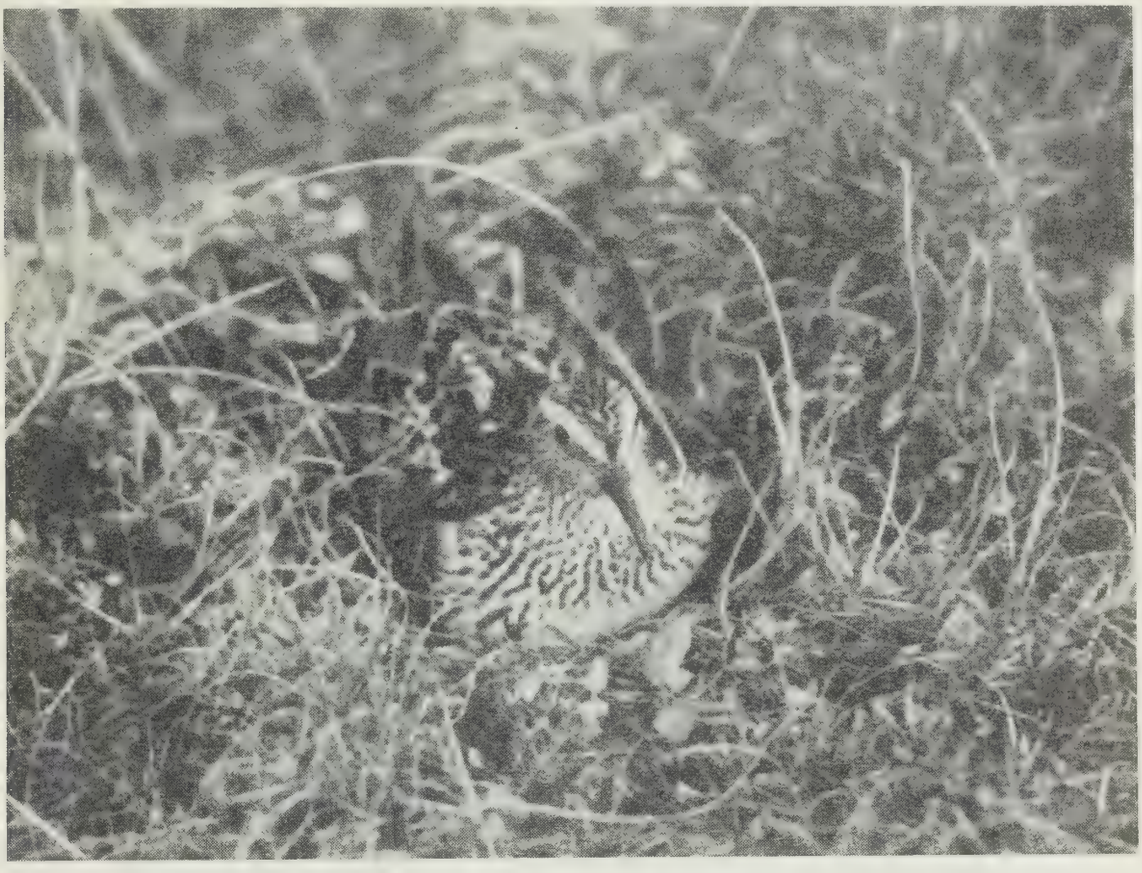
White-rumped Sandpiper, *Pisobia fuscicollis.* On the east side of Baffin island it has been noted, as a migrant only, on Cumberland sound. It has been found breeding on southwestern Baffin, Somerset, southeastern Victoria, and Melville islands. Other information of Arctic occurrences is desirable.

Baird's Sandpiper, *Pisobia bairdi,* has a high northern distribution, at least to Smith sound. It has been found breeding on southern and northern Baffin island and southern Victoria island but not on Southampton. Other reasonably assumed or demonstrated nestings are for Etah, Greenland, southern Ellesmere island, and Melville island.

Least Sandpiper, *Pisobia minutilla.* Records of this species are very likely to be confused with the similar Semipalmated Sandpiper but it is not as northern as that species. It nests on the shores of Hudson bay, the bottom of Ungava bay and northern Labrador, but probably not beyond the neighbourhood of the tree limit.

Red-backed Sandpiper, *Pelidna alpina.* The American form of the Dunlin has been noted through the interior of the archipelago—breeding on Southampton and southwestern Baffin islands south to Churchill. Observed on Melville island and the Boothia peninsula. It has not so far been reported from the extreme east coasts.

Stilt Sandpiper, *Micropalama himantopus*, extends northward barely to the southern edge of the Arctic islands. It is western rather than eastern in its distribution, occurring on the western side of Hudson bay to Chesterfield inlet, but has not so far been reported on the east side or on Southampton island. The only record beyond the main coast is for southern Victoria island.



White-rumped Sandpiper on Nest

Semipalmated Sandpiper, *Ereunetes pusillus*, may be easily confused with the Least Sandpiper. It breeds commonly on the main coast from Coronation gulf westward. There are records of occurrence on southern Baffin island and it nests on Southampton island and southward on Hudson bay and the Labrador coast.

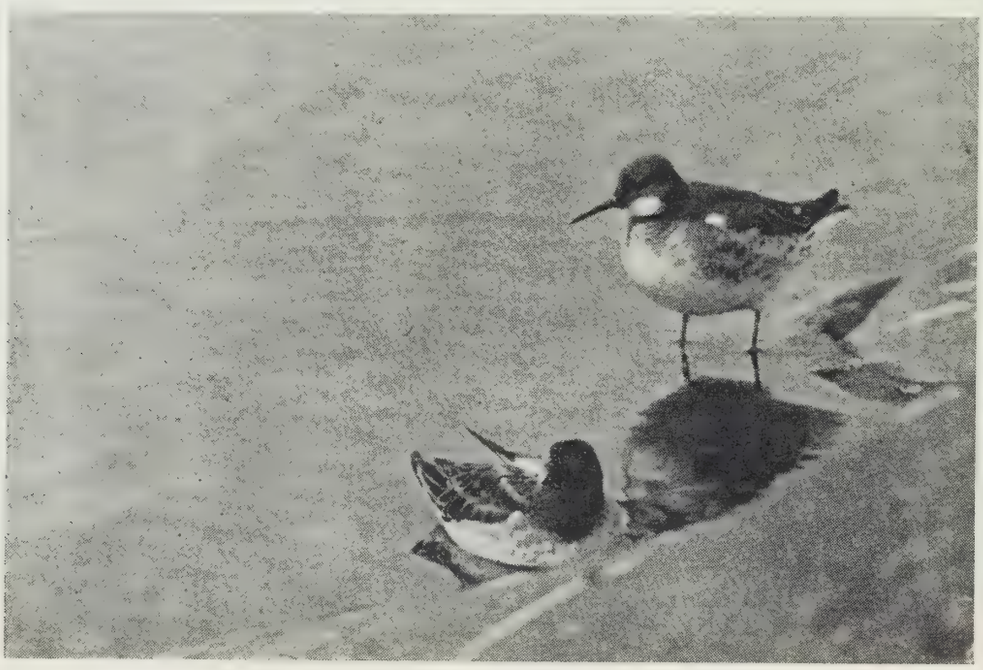
Buff-breasted Sandpiper, *Tryngites subruficollis*. There are reports of occurrence at Port Burwell and of probable breeding on Melville island, but in neither case is the evidence quite satisfactory. It occurs as a migrant down the west side of Hudson bay. The only substantiated breeding records are for the northwestern main coast.

Hudsonian Godwit, *Limosa haemastica*. The breeding range of this species is much reduced from that originally occupied. It still nests on the west side of Hudson bay, did so in the Anderson river region east of the Mackenzie delta and probably westward from there. It is a rare summer resident on Southampton island. There are old reports of godwits, probably this species for Cumberland sound.

Sanderling, *Crocethia alba*, is apparently common in the interior and western side of the archipelago but scarce in the extreme eastern portions. Probably occasional on Hudson strait and Cumberland sound. Breeds on Southampton island, the Melville peninsula, northern Ellesmere island and adjoining Greenland and probably on Melville island. There are numerous records of occurrence for the western Arctic.

Red Phalarope, *Phalaropus fulicarius,* is the more northern and the most generally distributed of the phalaropes, probably breeding all over the Arctic islands, except on the extreme eastern rugged shores, north to Smith sound. Except while actually breeding, a pelagic species often met with in considerable numbers swimming like miniature ducks far out in the open waters or at sea. Their migrations are to sea well off shore both sides of the continent, rarely coastwise and only accidentally inland. The most southern nesting records are on Hudson bay and the mid Labrador coast.

Northern Phalarope, *Lobipes lobatus,* in spite of its name, is not as northern as preceding species. It is of very similar habits but migrates through the interior as well as along the seacoasts. It has been detected breeding north only to Southampton island, northern Labrador and the northwestern mainland.



Northern Phalaropes

Jaegers and Skuas

Pomarine Jaeger, *Stercorarius pomarinus,* has a slightly less northern distribution than the other two Jaegers. Our northern records, all breeding, are from Cumberland peninsula, Somerset, Melville, and Banks islands south to northern Labrador, Southampton and probably the northwest main coast.

Parasitic Jaeger, *Stercorarius parasiticus,* seems to be a more or less common breeder from northern Labrador and Hudson bay to northern Ellesmere island and westward to Banks island.

Long-tailed Jaeger, *Stercorarius longicaudus,* is like the Parasitic, generally distributed though probably not breeding quite so far south.

Northern Skua, *Catharacta skua.* Old sight records from Lancaster sound southwards and breeding off southeast Baffin island need confirmation.

Gulls

Certain species are omnipresent in the Arctic, some remaining far north in winter wherever open water may occur.

Glaucous Gull, *Larus hyperboreus,* is the commonest and most generally distributed gull of the Arctic as well as the largest and most conspicuous. It breeds throughout the Arctic south to Newfoundland and Hudson Bay, probably wherever there are suitable sea cliff conditions.

Iceland Gull, *Larus leucopterus,* is a smaller edition of the Glaucous Gull and so like it that the records of the two species have often been confused. As a matter of fact the only well substantiated records in the North American Arctic are summer non-breeders and autumn birds from southeastern Baffin island and vicinity. It is a common winter visitor on the Atlantic coast south to Nova Scotia. The species breeds in Greenland but many if not all the current American nesting records are inextricably mixed with those of the larger species. Definite evidence of New World nestings is desirable.

Great Black-backed Gull, *Larus marinus,* breeds up the Labrador coast probably occasionally to cape Chidley. It may wander northwards across the strait but present evidence to that effect is not satisfactory.

Herring Gull, *Larus argentatus,* is common throughout the Arctic, southward to New England and the Great Lakes. The northern birds, breeding south to northern Baffin island and the northwest main coast, belong to the race Thayer's Gull, *L.a. thayeri.* Those nesting from southern Baffin and Southampton islands southward are the common American Herring Gull, *L.a. smithsonianus.* The exact line along which the two forms meet is uncertain.

Kumlien's Gull, *Larus kumlieni,* though regarded by some as a hybrid between Thayer's and Iceland Gulls this is undoubtedly a distinct species for as yet its only known nesting localities are far removed from the breeding range of either of these forms. The demonstrated breeding localities for the species are, Cumberland sound, southwestern Baffin island, and on the mainland across the strait near cape Wolstenholme.

Nelson's Gull, *Larus nelsoni,* is a little-known species, a larger and more western edition of the previous one and bears about the same relation to it as the Glaucous does to the Iceland Gull, but very few specimens are known to science. A bird taken just south of Cornwallis island is referred to this species.

Bonaparte's Gull, *Larus philadelphia,* has been reported as breeding on Southampton island but the record lacks confirmation. The treeless condition of this locality and the known habits of the species make it seem very unlikely.

Ivory Gull, *Pagophila alba.* We have summer records of this species throughout the Arctic from southeastern Baffin island to Prince Patrick island. A number of breeding records—Port Bowen, Prince Regent inlet, Darnley bay and others—seem probable but cannot be verified. A set of eggs taken from a "small white gull" Lat. 80° 30′ W., Long. 102° N., have every appearance of being of this species.

Kittiwake, *Rissa tridactyla,* is common from the gulf of St. Lawrence to northern Ellesmere island. It seems of eastern distribution, nesting in colonies along both sides of Baffin bay and Davis strait. Its extension westward is not certain. The reported breedings on Somerset island and Prince Regent inlet are not improbable, but occurrence at Franklin bay and on northwestern Victoria island have not been substantiated by recent observers and are open to doubt.

Ross's Gull, *Rhodestethia rosea,* is next to Nelson's, the rarest of the Arctic gulls. Of purely Arctic distribution it rarely wanders from its icy habitat. Its centre of distribution and breeding area is on the north Siberian coast, but at times it appears off the northwest mainland of America in considerable numbers. Otherwise it has been reported in only a few instances on the Boothia and Melville peninsulas and a few points in Greenland from Melville bay southward.

Sabine's Gull, *Xema sabini,* is generally distributed through the Arctic, breeding along the continental coast from southwestern Baffin and Somerset

islands to Bering sea northward through the interior of the archipelago to Ellesmere island. It seems to be a bird of the low, flat shores rather than of the high bold coasts. Its only known winter range is off the Peruvian coast and its migration is probably westward and at sea down the Pacific. There are sporadic records of individual occurrence in the interior of the continent.

Arctic Tern, *Sterna paradisaea,* is generally distributed throughout the Arctic area from highest north on Ellesmere island south to Hudson bay and New England. Records along the west shores of Davis strait and Baffin bay are few and it is probably more common on the lower islands of the interior of the archipelago. Reports of the Common tern, *Sterna hirundo,* anywhere within Arctic conditions probably refer to this species.

Sea Divers

This family is largely northern in distribution but is not nearly as well represented in the Eastern Arctic as in Bering Sea.

Razor-billed Auk, *Alca torda.* Though reported from Greenland at Disko island, records from the Canadian side north of Lat. 55° must be regarded as doubtful.

Common Murre, *Uria aalge.* The same remarks as under Razor-billed Auk can be repeated here, though there are circumstantial records of occurrence in Hudson bay.

Thick-billed Guillemot, *Uria lomvia.* The eastern American form Brunnich's Murre, *U. l. lomvia,* occurs commonly all along Labrador and the coasts of Davis strait and Baffin bay to Smith sound nesting locally in immense "loomeries." It penetrates Lancaster sound at least to Somerset island and Hudson Strait to Cape Wolstenholme. Its occupancy of the rest of the interior of the archipelago is uncertain.

Dovekie, *Alle alle,* nests in immense colonies on the broken rock faces of northwestern Greenland to Etah, but there is no evidence of its breeding anywhere on the Canadian side of the channel. Throughout the summer the open water between the ice packs of Baffin bay are thronged with incredible millions of these little birds and they are regular winter visitors to the shores and harbours south to Nova Scotia and beyond.

Black Guillemot, *Uria grylle,* is a common and generally distributed breeder along all seacoasts from Maine to northern Ellesmere island and into the interior of the archipelago to Melville island, via Jones and Lancaster sounds and to Hudson bay through the strait. Evidences of occurrence about the large southwestern islands are lacking and it does not occur on the adjoining mainland coasts. These birds are the northern form, Mandt's Guillemot, *U. g. mandti.*

Atlantic Puffin, *Fratercula arctica,* though reported on the Greenland side as far north as Smith sound we have no records of occurrence on the Canadian side north of or on Hudson strait.

Nocturnal Birds of Prey

Snowy Owl, *Nyctea nyctea,* is generally distributed over all the Arctic islands and adjacent mainland north to Ellesmere island, breeding wherever found there.

American Hawk Owl, *Surnia ulula,* has been taken at Chimo.

Little Boreal Owl in its American form Richardson's Owl, *Cryptoglaux funerea richardsoni,* with the American Hawk Owl *Surnia ulula caparoch,* probably occurs wherever the tree line approaches Ungava or Hudson bays.

Willow Ptarmigan Visiting Camp

Woodpeckers

Woodpeckers will occur in this region only where the timberline closely approaches Hudson and Ungava bays.

Yellow-shafted Flicker, *Colaptes auratus,* has been taken as wanderer on mainland opposite Apkatok island, Ungava bay and at cape Wolstenholme.

American and Arctic Three-toed Woodpeckers, *Picoides tridactylus* and *P. arcticus* will undoubtedly be found locally approaching Hudson bay coast.

Kingbird, *Tyrannus tyrannus.* A stray specimen taken at Port Burwell just qualifies the species for mention here.

Song Birds

Horned Lark, *Otocoris alpestris,* is a fairly common breeder on southwestern Baffin and on Southampton islands southward. Northern records of occurrence are Admiralty inlet and Boothia peninsula. Two subspecies are represented in these birds. The northern Horned Lark, *O. a. alpestris,* seems the prevailing one on Baffin island and as a migrant on Southampton, while Hoyt's Horned Lark, *O. a. hoyti* is the breeding form on the latter and westward.

Three swallows have been reported as wanderers in the region,

Tree Swallow, *Iridoprocne bicolor,* has been taken on Southampton island.

Barn Swallow, *Hirundo erythrogaster,* has been reported on Mansel island at the mouth of Hudson bay.

Bank Swallow, *Riparia riparia.* A colony has been reported from Melville island with details that almost carry conviction.

Raven, *Corvus corax,* occurs throughout the Arctic north to Ellesmere island and both east and west. It breeds wherever found and remains through the winter in many localities.

Wheatear, *Oenanthe oenanthe,* is an Old World species that probably occurs sparingly and locally all over the Arctic in the east occasionally to the gulf of St. Lawrence, in the west to central Alaska. It is much more common in Greenland. Canadian records are few but well scattered, Ellesmere island, Cumberland peninsula, southwestern Baffin island, Boothia peninsula, and the mouth of the Mackenzie. It probably nests wherever found. As only rare stragglers have been taken farther south on this continent the Eastern Arctic birds must migrate via Greenland and Iceland to Europe. The supposition is that the western birds pass to Asia.

American Pipit, *Anthus spinoletta,* is common on Ungava peninsula to southern Baffin island westward to Southampton island and the mainland beyond.

Arctic Redpoll, *Ascanthis hornemanni.* There are two quite distinct subspecies of this Redpoll. The Greenland Redpoll, *A. h. hornemanni,* decidedly the largest of the Redpolls is a Greenland breeder, probably north of latitude 70°. On the Canadian side it is known only as a migrant or winter visitor to southern Baffin island, northern Ungava and Southampton island. It rarely goes farther south than Churchill. The Hoary-Redpoll, *A. h. exilipes* is much like but smaller and of less northern distribution than the last. Breeds on Southampton island, westward along the mainland and southward on Hudson bay, migrating well into the United States in winter.

Redpolled Linnet, *Acanthis linaria,* in its several forms is a common breeder across the northern parts of the continent. The Common Redpoll, *A. l. linaria,* the smallest race nests on the Labrador peninsula, and the less northern parts of Hudson bay westward. It is scarce on Southampton island, but the commonest redpoll in migration to the United States. The Greater Redpoll, *A. l. rostrata,* considerably larger than the Lesser, seems to breed in Greenland but has been observed in Canada only as a migrant. It is fairly common in migration in northern Labrador, southern Baffin island and on Southampton island and southward in lesser numbers. Holboell's Redpoll, *A. l. holboelli,* intermediate in size between the above is a European form and it is probable that the American specimens that have been referred to it are intergrades between *linaria* and *rostrata.*

Red Crossbill, *Loxia curvirostra,* and White-winged Crossbill, *Loxia leucoptera,* have both been reported from Hudson strait but without substantiating evidence. However, it undoubtedly occurs wherever the timberline approaches the northern shores of Ungava peninsula or Hudson bay.

Slate-coloured Junco, *Junco hyemalis.* Stray specimens have been taken in southern Baffin and Southampton islands. More common southward where the timberline approaches the coast.

Lapland Longspur, *Calcarius lapponicus,* a circumpolar species breeding in North America from Labrador to Bering sea and north at least to Devon and Melville islands.

Snow Bunting, *Plectrophenax nivalis,* a common circumpolar breeder throughout the Arctic southward to Southampton island and the mainland coasts. It is notable that a bird banded on winter migration in the northern peninsula of Michigan was taken the following spring in southwestern Greenland, suggesting that the west Greenland birds migrate to America instead of, as do many birds, to Europe.

FISH

The extension of the Hudson Bay railway to Churchill opened a prospective prairie market for fish, and interest in the commercial fishery possibilities of the Hudson Bay region was revived. It is probable that had the fishery resources of the bay been at all rich commercially that fact would have been established long before the Hudson Bay railway was heard of. However, the bay is an immense body of water and the Department of Fisheries decided to carry out a careful investigation.

During the summer of 1930 a well-equipped and well-manned steam trawler, the *Loubyrne,* was sent to make fishery trials throughout the open bay. The *Loubyrne* was engaged in actual fishing operations in Hudson bay for twenty-two days. During that time two hundred miles of bottom representative of the whole region were efficiently dragged for commercial fish. Added to this, other methods of fishing were tried. Not a single commercial fish was taken.*

The results of investigations up to and including the 1930 expedition are summarized by Dr. A. G. Huntsman, Director, Atlantic Biological Station, in his paper: "Biological and Oceanographic Conditions in Hudson Bay: 1. Hudson Bay and the Determination of Fisheries," as follows: "The waters of Hudson bay, though potentially rich, do not present suitable conditions for the development of fisheries of any magnitude. Fresh water from an extensive drainage basin mixes only superficially with the salt water, so that the bay has an estuarial character, apart from the somewhat barren deeper Arctic water, with the fisheries largely those of the rivers emptying into it." However, the river fisheries were stated to be of definite value although doubt was expressed as to whether these could be made great enough for the needs of the local population.

The subject is dealt with in a more comprehensive manner by Dr. V. D. Vladykov in his paper "Biological and Oceanographic Conditions in Hudson Bay: 9. Fishes from the Hudson Bay Region (Except the Coregonidae)." Six collections of fish from Hudson strait and bay and James bay were studied. The material consisted of forty-five different forms belonging to forty-two species. Amongst the fish listed by Dr. Vladykov and by Dr. J. R. Dymond of the University of Toronto (in their paper "Biological and Oceanographic Conditions in Hudson Bay: 8. The Coregonine Fishes of Hudson and James Bays," published by the Biological Board of Canada) are Whitefish; Cisco; Greenland Shark; Brook Trout, in streams running into Hudson bay; Arctic Trout (Arctic Char); Arctic Grayling; Arctic Cod; and common or Atlantic Cod, not usually taken west of Port Burwell; Greenland Cod; Salmon and Flounders, found only in Ungava bay. Atlantic types are only found in the eastern extremity of Hudson strait possibly due to low temperature and low salinity of the water.

Dr. Vladykov separates the known fishes into groups as follows:—

Twenty-one per cent of the fishes known are of definite economic value. Amongst these are Arctic Trout and Brook Trout; Greenland and Atlantic Cod; Salmon; Cisco, and two forms of Whitefish.

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* Report on the Hudson Bay Fisheries Expedition of 1930 by Mr. H. B. Hachey, officer in charge. (Information concerning this and other publications on Hudson Bay fisheries may be obtained from the Secretary of the Biological Board of Canada, Department of Fisheries Ottawa.)

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Thirty-five per cent are of secondary economic value. Several freshwater species such as Pike; Pike Perch; Yellow Perch; Burbot; Sucker; Goldeye; Chub; and Grayling are included in this category but are taken largely in areas outside the district covered by this report. Greenland Shark; Lumpfish; Sculpin; Capelin; and Sand Launce. Arctic Cod is placed in this category because of its small size.

Forty-four per cent of no economic value.

Dr. Vladykov summarizes his study as follows:—

(1) The low temperature and salinity of the Hudson bay region, together with the pronounced stratification of water, probably restrict the abundance of commercial fishes in respect to both number of species and number of individuals.

(2) The fishery prospects are not the same for different parts of the region: (*a*) James bay is the richest in fishes, the best districts being Albany river on the west and Big river on the east coast; (*b*) In Hudson bay the open sea is practically destitute of commercial fishes, the best fishing being along the east coast south from Richmond gulf; (*c*) In Hudson strait the most profitable locality is Ungava bay.

(3) Deep-water fisheries of so-called "ground fish" do not exist here.

(4) The most important commercial fishes are principally anadromous and rarely marine: (*a*) Whitefish, Cisco and Sturgeon all around James bay; (*b*) Brook Trout chiefly on the east coast of James bay; (*c*) Arctic Trout and Greenland Cod in Hudson strait and Hudson bay.

Cod Fishing

Eskimo cleaning cod caught by "jigging" at Port Burwell.

North of Hudson strait the fishery resources are not so well known. Arctic Char is taken as far north as Pond Inlet where they may be secured in quantity at the proper season of the year. The same may be expected at the mouths of streams farther south on Baffin island.

Cod (not more definitely described) were reported by the Royal Canadian Mounted Police as being plentiful at the south end of Admiralty inlet and it was stated that a shark, presumably a Greenland Shark, was seen swimming in the water at Pond Inlet in the summer of 1933. North of Baffin island fish life apparently becomes more scarce. The non-commissioned officer in charge of the Ellesmere island detachment for the past two years reported having tried several times to catch fish in that area without success.

So far as the inhabitants of the Eastern Arctic are concerned Arctic Trout or as it is more familiarly termed 'Arctic Char', is undoubtedly the species of most economic importance. The fishing seasons are short and occur during what is normally a period of plenty. On this account the natives probably do not take advantage of them as much as they otherwise might. A few fish are dried in some areas. The Section Manager of the Hudson's Bay Company for the Ungava district intended fixing up a smokehouse at Fort Chimo in an effort to educate the natives in the preservation of salmon for future use when fresh fish were not to be obtained. The results of this experiment will not be known until next year. Up to two or three years ago there was a demand in Europe for pickled salmon and the Company shipped out annually from 150 to 200 tierces. The market weakened and the Company conducted a further experiment, sending a steam trawler, fitted with refrigerator equipment, from St. John's, Newfoundland, to collect salmon at Georges river, Whale river, and Koksoak river. The experiment was not repeated.

Report of Mr. J. D. Soper

Mr. J. Dewey Soper, Investigator of the Department of the Interior, spent several years in southern Baffin island and reported on the following species of fish taken in the district between Lake Harbour and Cape Dorset.

Boreogadus saida, Northern Pollack.—This species appears to be scarce, though occasional individuals are taken in the shallow coastal waters from at least Cape Dorset to Lake Harbour.

Pygosteua pungitius brachypoda, Arctic Stickleback.—As this species was taken in mountain tarns at Cumberland sound in 1924, it is probably to be looked for in the highland lakes and ponds of the whole of southeastern Baffin island. They occur to at least 800 feet above sea-level.

Gastrosteus aculeatus, Common Stickleback.—Numerous in the fresh, or slightly brackish pools and ponds in the Lake Harbour district. They show a distinct preference for very shallow ponds, with narrow ramifying arms, interspersed with small grassy islands, or hummocks. Here they swim about individually, or in little bands where the water is noticeably warmer than in the deeper parts; when alarmed these little fish have the habit of darting with great rapidity into crevices along shore, or into the muddy bottoms of the ponds, where they become instantly concealed. The species is doubtless distributed throughout the whole of southern Baffin island, as in addition to Lake Harbour, it has been seen or collected by the writer at Cumberland sound, Nettilling lake, Cape Dorset and Amadjuak bay.

Myozocephalus groenlandicus, Greenland Sculpin.—Appears to occur all along the south coast of Baffin island. Sculpins referred to this species are common at various places, such as Cape Dorset, Amadjuak bay and Lake Har-

bour. Eskimos sometimes amuse themselves by hooking the fish on short lines in the shallow water along the seacoast.

Oncocottus hexacornis, Long-horned Sculpin.—Fairly commonly distributed along the south coast of Baffin island. These, together with the Greenland sculpin, are occasionally caught and eaten by the Eskimos. Only a small portion of each fish is edible, as it is largely grown to head and possesses many objectionable spines. The Eskimo dogs also catch and feed upon sculpins to a limited extent at the low phase of the tide during the summer. Sculpins have little economic value in the Arctic.

Salvelinus alpinus, Arctic Char.—The Arctic Char is locally common along the seacoasts of the whole of southern Baffin island from at least Cape Dorset to Cumberland sound. It is probably this species that resorts in large numbers to various streams mentioned by the Eskimos on the east coast of the island north of the Cumberland peninsula, and at Salmon river, Pond Inlet. It also occurs in Nettilling lake, and numerous other lakes near the south coast and at Frobisher bay.

At the mouths of numerous rivers throughout the southern part of the island these fish resort, during late July, in immense numbers and are netted or speared by the Eskimos. In certain lakes these people also spear them in quantities through holes in the ice. They are most active in this during early winter and spring. In small lakes near Lake Harbour the Eskimos secured some fine specimens in November and again in April and May. These fish are fine-flavoured, much sought after by whites as well as Eskimos, and have real economic importance. During the run in July, many of the natives practically subsist on Arctic Char alone for several weeks.

The average weight of these fish netted in large quantities, during the summer run from salt water to the rivers, is about $3\frac{1}{2}$ to 4 pounds, and the average length 19 or 20 inches. The largest specimens secured are around 28 inches in length and weigh 9 or 10 pounds. A very young specimen secured at Lake Harbour on June 17 was $2\frac{1}{8}$ inches long and distinctly barred over the sides; it was associating with common sticklebacks in a freshwater pool about a mile from salt water and 50 feet above it. Adults are generally dusky greenish above, ashy, or creamy-white below with numerous reddish, or orange-coloured spots; immatures up to about 10 inches in length, are blackish above and pale red over the underparts; the very young, such as the specimen mentioned above, are almost universally dusky with darker transverse bars on the sides of the body.

In different parts of the country, Eskimos speak of finding adult "trout," or "*Ecalu,*" in freshwater lakes, which they assert are different from the familiar Arctic Char of salt water. It is said that not only do these fish differ somewhat externally, but they have flesh of a different colour. In some cases, at least, the Eskimos claim that these char remain permanently in the lakes in which they are found. It is possible that there may be one or more well-marked varieties.

ARCTIC FLORA

By R. M. Anderson, Ph.D.

The flora of Arctic America has been of interest to scientists from the time of the earliest explorers. Many of the early British explorers, Parry, Ross, Franklin, Richardson, Sabine, Belcher, M'Clure, M'Clintock, Rae, and others brought back collections of plants which were described by famous British botanists, Robert Brown, Sir W. J. Hooker and his son Sir J. D. Hooker and others, in numerous reports, including the classic "Flora Boreali-Americana" (Hooker, W. J., 2 vols., 1833-1840.)

After the conclusion of the intensive explorations of the "Franklin Search" voyages, interest in the Arctic lessened. Some northern plants were collected by expeditions of A. P. Low, Robert Bell, James M. Macoun, and others, and brief lists published, as well as records in Prof. John Macoun's "Catalogue of Canadian Plants" (1883-1890). Professor C. H. Ostenfeld of Copenhagen published parts of a "Flora Arctica" in 1902, and a report on "Vascular Plants collected in Arctic America by the Gjöa Expedition" (Amundsen's) in 1910. Dr. H. G. Simmons, botanist of the Sverdrup Expedition in 1898-1902, also published valuable papers, "The Vascular Plants in the Flora of Ellesmereland" (1906) and "A survey of the phytogeography of the American Arctic Archipelago" (1913). Various members of the Canadian Arctic Expedition of 1913-1918 collected plants extensively along the Western Arctic Coast from northwest Alaska to Bathurst Inlet, Northwest Territories, and the results have been published in the scientific reports of the expedition: Volume IV (*Botany*), (A) Freshwater Algae and Freshwater Diatoms, by Chas. W. Lowe; (B) Marine Algae, by F. S. Collins and M. A. Howe; (C) Fungi, by John Dearness; (D) Lichens, by G. K. Merrill; (E) Mosses, by R. S. Williams; (F) Marine Diatoms, by Albert Mann. Volume V, *Botany,* (A) Vascular Plants, by James M. Macoun and Theo. Holm; (B) Contributions to Morphology, Synonymy, and Geographical Distribution of Arctic Plants, by Theo. Holme; and (C) General Notes on Arctic Vegetation, by F. Johansen.

Realizing the scattered and necessarily incomplete nature of the data available on the flora of Arctic Canada, the late M. O. Malte, Ph.D., for many years Dominion Agrostologist in the Department of Agriculture, and since 1921 Chief Botanist, National Herbarium, Department of Mines, proposed to consolidate the knowledge of the flora of Arctic Canada now found in scattered publications and in the form of only partly described collections in various herbaria in Europe and North America, the same to form the first of a proposed series of works on the floral provinces of Canada. The National Museum of Canada finally arranged to have a systematic work prepared on the Flora (phanerogamic—seed plants or flowering plants) of the Canadian Arctic Archipelago and the mainland of North America north of a line from Hamilton inlet along the coast of Labrador to Ungava bay, thence to Richmond gulf, from Churchill to the Mackenzie delta and thence along the Arctic coast about to Nome, Alaska, this line to coincide approximately with the tree line.

As this extensive work involved the study of collections of Arctic and Sub-Arctic plants in museums and herbaria in London, Copenhagen, Ottawa, Toronto, Washington, Stockholm, Paris, Leningrad, New York, and Cambridge, (U.S.A.) the first three being the most important for the purpose of the work, the National Museum of Canada arranged in 1927 for Dr. Malte to have the

co-operation of Professor C. H. Ostenfeld, Director of the Botanic Garden of Copenhagen and considered the leading European authority on Arctic plants. Professor Ostenfeld worked intermittently as his other duties permitted, until his untimely death on January 16, 1931, and made critical examination of the most important material in Ottawa, London, and in the Scandinavian countries. Dr. Malte, who had previous experience in northern botanical work in Sweden and in Yukon Territory, began more intensive work on the Arctic plants, and on three expeditions visited a large number of Arctic localities from which collections of plants were needed to complete our knowledge, and was enabled to make detailed observations on the Arctic plants as they grow and the various plant assemblages under different conditions of soils and climate.

Arctic Cotton (*Eriophorum* species)

A coarse herbaceous plant which thrives in cold, boggy soil. The numerous white heads present a very striking and pleasing appearance. The Eskimos use this cotton to some extent for tinder, as well as cotton found on willows.

Dr. Malte, in addition to having thorough training and sound judgment in systematic botany, was a keen and observant collector and a prodigious worker in the field. Knowing the plants intimately, he was able to spot the rare (or, in many cases, the inconspicuous) species which are not noticed by untrained or casual collectors, and every field trip brought in new botanical treasures.

Dr. Malte accompanied the Canadian Arctic Expedition of 1927 on the ss. *Beothic*, leaving North Sydney, Nova Scotia, July 16, and returning to the same port September 4, after visiting the following points where botanical specimens were collected: Dundas Harbour, Devon island; Craig Harbour, and Bache Peninsula, Ellesmere island; Erebus Bay, Beechey island; Port Leopold, Somerset island; Arctic Bay (Admiralty inlet), Pond Inlet, Albert Harbour, Clyde River, Pangnirtung, and Lake Harbour, Baffin island; Wakeham Bay and Port Burwell, Hudson strait.

Herbarium sheets to the number of 3,778 (including a much larger number of duplicate series) were collected and preserved in excellent condition. On his return Dr. Malte wrote that his preliminary determinations showed that

he had obtained at Dundas Harbour, 27 species not previously known to occur on Devon island, although most of them occur both on Baffin island and on Ellesmere island. These records filled gaps in the geographical distribution, and five of the species, viz: *Hierochloë pauciflora, Carex scirpoides, Tofieldia palustris, Rhododendron lapponicum,* and *Mertensia maritima,* mark an extension of the previously known range, not being heretofore recorded from north of Baffin island.

On Baffin island in 1927 Dr. Malte obtained twenty species of plants new to that island, and of these eight species, and possibly nine, had not up to that time been recorded from any of the Arctic islands. The above records and the large number of important facts observed in connection with the work, in the short space of 77 hours of actual work ashore at a dozen ports of call on a 51-day voyage, show what a field there is for botanical work. It may be stated that the time between ports is also a busy period, as the large quantities of specimens obtained on shore have to be pressed, dried, labelled, and notes written up before arriving at the next port.

In 1928 Dr. Malte obtained passage on the Hudson's Bay Company's ss. *Nascopie* sailing from Montreal early in July and returning to St. Johns, Newfoundland, September 10. Collections were made at the following points: Cartwright, Labrador; Port Burwell, Wakeham Bay, and Cape Wolstenholme, Hudson strait; Lake Harbour and Cape Dorset, Baffin island; Southampton island, Port Harrison, Smith island, and Chesterfield Inlet, Hudson bay. On this voyage a total of 5,683 herbarium sheets was collected and preserved.

In 1933, the Hudson's Bay Company's ss. *Nascopie* was engaged by the Department of the Interior to transport personnel and supplies for the Canadian Government to the Eastern Arctic posts. As the vessel was also to call at the numerous posts of the Hudson's Bay Company in the region, including the coast of Labrador, Hudson strait, Hudson bay, and James bay, and after that the posts in the Eastern Arctic Archipelago, as far as Ellesmere island, an opportunity was offered to visit a number of new localities as well as to collect supplementary material at points previously visited. Dr. Malte therefore sailed on the *Nascopie* from Montreal, July 8, 1933. While he was with the expedition the following points were visited and collections made: Lake Harbour, Baffin island; Port Burwell, Wakeham bay, and Sugluk, on the south side of Hudson strait; and Port Harrison on the east side of Hudson bay.

A total of 1,364 herbarium sheets was collected at the above localities. Dr. Malte wrote on August 5, 1933, when approaching Charlton island in James bay, that " The two days which we spent at Port Harrison gave botanical results beyond all expectations. It took me two full days, from 9 a.m. to about 7 p.m., to prepare the specimens collected and it was only last night that I finished the job."

Some species had been secured on the trip that were not before known from the Arctic zone. Unfortunately, Dr. Malte, who had not been in the best of health, was taken ill at Charlton island. He was obliged to start for home without completing the voyage, and died on August 12, 1933, shortly before reaching Ottawa. A great botanist and a kindly man had passed after leaving an important contribution to the foundations of Canadian botany.

A brief statement of Dr. Malte's field methods may be useful to botanists accompanying future expeditions. Collecting botanical specimens from a ship in the Arctic has the disadvantage of missing some of the earlier flowers in the blooming season, as most of the snow disappears from the land long before the sea ice opens enough for ships to come in. However, many of the species may be found blooming later in the season in places where the snowdrifts have remained longer. Dr. Malte found that even on the short stops of from one to three days in each port he could go ashore and collect large quantities of plants and spend the time at sea between ports in sorting and drying them.

He made a point of collecting liberal numbers of "duplicates," to show variations and for exchange purposes, as well as different stages of flowering and fruiting, if possible. Instead of using the ordinary tin vasculum for collecting, Dr. Malte used a potato sack. Individual collections were wrapped in paper when gathered in the field and dumped into the sack. In this way large quantities could be collected in a comparatively short time without danger of mixing the specimens, and time was saved in sorting material when putting it into the press. Instead of the ordinary felt paper in the plant press, he used corrugated paper boards or so-called ventilators, with the corrugations running at right angles to the length of the boards. The plants were spread directly on the boards and when the stacked boards made a good-sized bundle they were strapped tightly and placed on the fiddley ladder, i.e., the grating right over the boiler in the engine room. In forty-eight hours the plants were perfectly dried without bother of changing and drying felt papers. The only attention needed was a tightening of the straps now and then, due to comparatively rapid shrinking of the specimens. When sufficiently dried, the plants were taken out and placed on thin sheets of herbarium size, numbered, and entered in the notebook. This method preserved the colour of flowers and foliage much better than when felt papers were used.

The flora of the Arctic has an economic significance as great as any other factor of its life conditions. The amount of wood suitable for building purposes and fuel is limited to a few areas and, owing to the slow growth of trees during the short summers, timber which is consumed is very slowly replaced. The Arctic areas suitable for agriculture and gardening are also limited and comparatively little vegetable food for human use can be raised. However, all food of animals comes ultimately from plants, directly assimilated by the large hoofed mammals and by large and small rodents, and indirectly by all the flesh-eating predators which prey on the herbivorous species.

While the Arctic regions as a whole have fewer plant species than other parts of the world, in some areas the vegetation is dense, although the distribution is unequal. Differences in fertility of soil and other physiographic factors tend to produce richer vegetation and consequently better food for animals than other areas do. Having these facts in view, as well as several previous unsuccessful attempts, when the Canadian Government decided to introduce domestic reindeer into the Mackenzie District, in April 1926, they engaged Mr. A. E. Porsild, with his brother, Mr. Robert T. Porsild, an assistant, to make a study of the ranges where reindeer are being successfully raised in northwestern Alaska, and later to select suitable range in Canadian territory where the reindeer would not suffer on account of lack of forage plants and shelter. Between May 1926, and November 1928, the Porsild brothers travelled 15,000 miles by dog-team, canoe, motor boat, pack-dogs, and snowshoes, studying this essentially botanical problem, collecting about 15,000 herbarium specimens of vascular plants and nearly 5,000 specimens of cryptogams. A brief summary of the more practical results of this reconnaissance is given in Mr. A. E. Porsild's report ("Reindeer Grazing in Northwest Canada, Report of an Investigation of Pastoral Possibilities in the Area from the Alaska-Yukon Boundary to Coppermine River," Department of the Interior, Northwest Territories and Yukon Branch, 1929, pp. 46, illustrated). With the view of ultimately extending the reindeer industry farther east, Mr. A. E. Porsild was sent north during the summer of 1930 to make an investigation of the region on the west side of Hudson Bay (Kazan river and other areas northwest of Churchill), after which Mr. Porsild went to Coats island in the northern part of Hudson bay and made a brief investigation of the flora, particularly as a grazing ground for caribou and reindeer. During June and July 1929, Mr. Porsild travelled to James

bay via Moose Factory (near Moosonee) and made a brief biological reconnaissance of Akimiski island and a more extended survey of Charlton island. The botanical survey of Charlton island included a trip by canoe around the island and about 100 miles travel across country on foot. Since 1931 Mr. Porsild's work has been outside the Eastern Arctic area but he has continued botanical study and collecting as time permitted and the Porsild collections of Arctic plants now number nearly 30,000 specimens. When these are completely worked up in detail they will add greatly to our knowledge of Canadian Arctic plants and their distribution.

THE GEOLOGY OF EASTERN ARCTIC CANADA

By L. J. Weeks, B.Sc., Geological Survey, Department of Mines

It is proposed in this section to give a brief résumé of the more important sources of geological information regarding Eastern Arctic Canada, a brief summary of the geology of the major subdivisions of the region, and a summarized geological map.* It would be inadvisable to go into geological relationships in great detail, partly because of the paucity of information regarding some quite extensive areas, and partly because the original sources of such information as is available are readily accessible to those requiring such detail.

In this report, the term Eastern Arctic Canada is arbitrarily assumed to include that part of the District of Franklin lying north and east of Banks, Victoria, and King William islands, and the islands of Hudson bay which form part of the District of Keewatin. From a practical standpoint, the location of a northern point in either the Eastern or Western Arctic depends on the relative accessibility of that point from either an eastern or a western seaport.

The earlier explorers of this territory did not as a rule devote much of their time to a study of geological conditions along their routes of travel, and to those that gave the encountered rocks more than passing mention, their study was entirely secondary to their main objective, namely the accomplishment of the Northwest Passage. Later travellers in the region devoted more time to the study of rock exposures, often, no doubt, with the expectation of a mineral discovery, until, since the beginning of the century, no major expedition has set out for the north without a trained geologist among the personnel.

The geological information regarding these regions is still scanty, however. In very few cases is anything known of what lies a few miles inland, and hundreds of miles of coast have been geologically mapped with the aid of field glasses from the deck of a vessel. Work of this nature is, however, definitely of value, if for no other reason than as an aid in choosing localities for more detailed work later.

The geological observations of the earlier explorers were carefully gathered from the original sources by G. M. Dawson and published in 1886.[1] To P. Schei, geologist on the *Fram,* 1898-1902, we owe most of our knowledge of the rocks underlying Ellesmere and the Sverdrup islands.[2] A. P. Low, Commander and Geologist of the Canadian Government expedition on the *Neptune,* 1903-04, not only compiled all available information to that date, but personally visited a large number of well-separated points throughout the Arctic islands.[3] The most northerly point reached by Low was Pim island, in Smith sound, latitude 78° 40′. The United States Army expedition under First Lieutenant (now General) A. W. Greely, to Lady Franklin bay, near the north end of Ellesmere island, although making remarkable contributions to the geographical knowledge of the region, did not add to the geological information to any degree, partly because a trained geologist was not among the personnel, and partly because of the forced abandonment of a large number of the specimens.[4]

The three Canadian Arctic expeditions sent out by the Department of Marine and Fisheries under the command of Captain J. E. Bernier, from 1906

*The map will be found inside the back cover.

[1] Geol. and Nat. Hist. Survey of Canada, Vol. II, Part R., 1886.

[2] P. Schei; Appendix 1; New Land, Vol. II; by Otto Sverdrup, 1904.

[3] A. P. Low; The Cruise of the Neptune, 1903-04; Ottawa, Govt. Printing Bureau; 1906.

[4] Greely, A. W.; Three Years of Arctic Service; pp. 419 and 421, Vol. II.

to 1910, added considerably to the geological knowledge of northern Baffin island and the islands lying to the west of Devon island.[1]

For our knowledge of Melville and Boothia peninsulas and Somerset and Prince of Wales islands, it is necessary to turn to earlier explorers, of whom Sir John Ross, Dr. Rae, and Sir F. L. M'Clintock contributed perhaps more than the others.[2]

It is understood, in mentioning a few of the more important contributors to the geological knowledge of these regions, that their works are not the only sources of our information. Most, if not all, of the earlier narratives contain items of geological information which are of value in completing the geological picture, even though in their descriptions the writers had no idea of the contribution they were making.

GEOLOGIC DECRIPTIONS OF ISLAND GROUPS

Ellesmere and Sverdrup Islands

Rocks of granitic origin, referred to the Archaen by most writers, occur on the south coast of Ellesmere island east of Haven fiord, and on the east coast as far north as the south side of Buchanan bay, in Kane basin. On the western coast of the island, only Bay fiord is known to extend into exposures of these rocks, they being found on the east side of its most easterly extension. Similar rocks are found on the north coast between cape Columbia and Yelverton bay. Although these rocks have always been called Pre-Cambrian in age, in the vicinity of Craig Harbour, near the southeast extremity of the island the rock is found to be remarkably fresh and apparently unaltered. At Fram Haven, on Rice strait, the rock is predominantly a grey granite gneiss, with masses of included sediments. It would be impossible, considering the present status of information, to give a definite age to these rocks.

Overlying these rocks at varying elevations, there are frequently found fine grained buff limestones. At Craig Harbour, where the limestone capping to the cliffs much resembles the icing on a cake, no fossils have been found which throw any light on the age of these rocks. On the east coast of the island, where no limestone in place is visible, the presence of large quantities of limestone in the debris carried down by glaciers, indicates that it is present inland at elevations not found on the coast.

Schei describes two belts of Cambrian and Silurian rocks on Ellesmere island. The most southerly outcrops on Jones sound between Haven and Goose fiords and extends apparently east-of-north, similar rocks being found along a north-south arm at the extreme east of Baumann fiord. The northern belt outcrops on Kane basin between Knud peninsula and cape Norton Shaw and apparently extends southwesterly, rocks of a similar character being found at the northeastern extremity of Bay fiord. These rocks consist for the most part of limestones with some sandstones and conglomerates. The rocks found on the south coast between Haven and Goose fiords are very similar to the limestones found at an elevation of 1,000 feet at Craig Harbour, and possibly they occur at intervening points and at decreasing elevations as one proceeds westward.

A narrow belt of Devonian sediments was mapped by Schei as extending from some point north of the eastern end of Bay fiord, south and west to the southwesterly tip of Ellesmere island, whence it apparently continues on North Kent island and a large part of Devon island.

[1] Bernier, J. E. The Arctic Expedition of 1906-07; The Cruise of the Arctic, 1908-09; The Arctic Expedition of 1910.

[2] Ross, Sir John. Ross' Second Voyage; London, 1835.
Rae, Dr. John. Expedition to the Shores of the Arctic Sea in 1846 and 1847; London, 1850.
M'Clintock, Sir F. L. Voyage of the Fox in Search of Sir John Franklin; 1869.

From our scanty knowledge of the Sverdrup islands, it seems probable that they are predominantly underlain by rocks of Triassic age, which, in the vicinity of Eureka sound were found to be composed of quartz sandstones with subordinate schists and limestones. A belt of tilted and folded strata outcropping on Kennedy channel between cape Norton Shaw and cape Belknap, and which were classed by De Rance as Cambrian, are now believed to be probably an eastward extension of the Triassic of Eureka sound.

Beds of supposedly Tertiary age, and usually containing lignite, are found at numerous localities in this region, usually in valleys. The detrital material of the beds is believed to have been derived from the erosion of the surrounding higher land. Coal is found at Blaamenden on Fosheim peninsula, at the head of Stenkul fiord on Baumann fiord, on Graham island and at a number of localities west of Hall basin and Robeson channel.

Devon Island and the Islands West of it

The eastern half of Devon island is underlain by a granitic and gneissic assemblage similar in many respects to those rocks occurring in the southeastern parts of Ellesmere island. The eastern portion of Philpots island is quite low in comparison to the western part, and may possibly be underlain by later and softer rocks. On the south shore, on the west side of Dundas harbour, limestones appear capping cliffs of grey gneiss at elevations of about 1,000 feet. These rocks appear to dip to the westward, and towards the head of Croker bay apparently occur at a much lower elevation, although they do not occur at sea level east of cape Bullen. Although Devon island has been crossed north and south, a number of times, no geological information has been obtained owing to the extent of the ice cap which covers all the explored interior.

From cape Bullen to Macormick bay on the west side of the island, Devon island is fringed with cliffs of Silurian limestone, fossils from these rocks being first collected by Parry, and later by the Franklin search expeditions. No fossils have been yet found in the limestones overlying the gneiss at Dundas Harbour.

Rocks of similar characteristics and age are found to the west on Cornwallis island, to the southwest on Somerset island and to the south on Baffin island, while those rocks occurring on Cornwallis island apparently extend to the southwest and occur on the west side of Prince of Wales island.

The northwestern quarter of Devon island has been shown by Schei to be underlain by a continuation of the Devonian sediments which extend south and east in a narrow belt on the west side of Ellesmere island.

The islands lying west of Devon island and usually grouped together as the Parry islands are almost entirely underlain by carboniferous sediments with included coal seams. Melville island, so far as is known is completely underlain by these sediments, and with the exception of small exposures of Mesozoic rocks, so are Prince Patrick and Bathurst islands. From the latter island, striking northeast, these sediments are found on the northwestern part of Cornwallis island, Grinnell peninsula, and numerous small islands between Bathurst and Devon islands. These rocks consist of two major divisions, the lower being a close-grained white sandstone, containing coal beds and but few marine shells, and the upper blue limestone beds with an abundance of marine shells.

In addition to Tertiary coals to be described later under the heading of Baffin and Bylot islands, coals, mostly occurring in Carboniferous sediments, have been found at numerous localities in the Eastern Arctic.

Parry and Lyddon found coal on the shores of Lyddon gulf, Melville island. Peat and coal were reported by men of the C.G.S. *Arctic* near Phipps point, 12 miles east of Winter harbour. They also reported loose coal on the

beach between Fife and Winter harbours, Melville island. Bituminous shale was found on the shore of Chevalier bay.

Chief Officer Green of the *Arctic* reported a large seam of coal on the east side of Rodd head, north shore of Banks island. Coal was also reported by R. J. L. M'Clure on the middle of the west shore of Mercy bay, Banks island.

Small pieces of coal were found by F. L. M'Clintock on the south shore of Byam Martin island, and also on Bathurst island, on the shores of the most southerly arm of De la Beche bay and the shore northwest of Scoresby bay. Coal was also found at Sargent point, Bathurst island by Commander G. H. Richards when searching for Franklin.

Baffin and Bylot Islands

The east and south coasts of Baffin island are underlain by crystalline rocks of supposedly Pre-Cambrian age. Granitic intrusives and gneiss compose the greater part of this assemblage while schists and crystalline limestone are occasionally found, particularly in the southern parts. Graphite and mica are found in deposits, large enough to warrant their having been worked, the former at Blacklead island in Cumberland sound and both at Lake Harbour on Hudson strait.

Two areas of paleozoic sediments are found on Baffin island, the northern occurring in the territory surrounding Admiralty inlet and the southern, the territory surrounding and west of Nettilling lake. In addition a small exposure of Silurian limestone is known at Silliman's Fossil mount, near the head of Frobisher bay.

On the east side of Prince Regent inlet, the rocks forming the high cliffs of Baffin island are basal sandstones and shales overlain with limestones, which in places are interbedded with gypsum. At Arctic bay, on Adams sound, an arm of Admiralty inlet, shales are found overlain with sandstones and limestones, the whole assemblage being cut by basic dikes. A few miles northeast of the cliffs formed by these rocks are low exposures of quartzite having unknown relationships with the other rocks. On proceeding eastward in Lancaster sound, the contact between the sediments and the older crystalline rocks apparently rises higher and higher above sea level, showing the relationships to be very similar to those found on the south shore of Devon island. Mineralization has been reported from numerous localities near Admiralty inlet, although no work in the nature of development has been undertaken.

The southern area of Paleozoic rocks is physically quite different from those areas described around Admiralty inlet and the more northerly islands. In strong contrast to the high cliffs of the latter, Nettilling lake is only 103 feet above sea level, and vast areas of surrounding country do not rise more than a few feet above the lake. The existence of this lake and the presence of limestone in the surrounding country was first shown by Boas in 1883-84. These rocks were first believed by Bell to be Silurian, but in 1928 were shown by Gould to be largely if not entirely Ordovician.

Loose, poorly-consolidated sandstones and shales, often containing beds of lignite, and believed to be of Tertiary age are found on the south side of Eclipse sound west of Pond inlet, on both sides of Navy Board inlet, and at the head of Isabella bay on the east coast of Baffin island. Coal has been found in these rocks on Salmon river about three miles south of its mouth in Eclipse sound, and at Canada point and cape Hay, Bylot island. Coal mined from the first of these occurrences supplies a great deal of the local demand at Pond Inlet post.

Prince of Wales and Somerset Islands, Boothia and Melville Peninsulas

The northern and eastern shores of Somerset island are underlain by limestones, the western shore by granitic and gneissic rocks. The latter apparently form a band about seventy-five miles wide running east-of-south, as they are found also on the east side of Prince of Wales island. This band apparently continues with a fairly constant width south through Boothia peninsula, south of which it broadens and follows the coast both to the east and west. Between Boothia and Melville peninsulas, the coast, with the exception of the smaller Simpson peninsula is underlain by similar granitic rocks, although Sir John Ross reports outliers of limestone on the isthmus of Boothia peninsula.

Two main belts of limestone and associated rocks are thus found separated by granitic and gneissic rocks, the western occurring on the west side of Boothia peninsula and Prince of Wales island, and the eastern on the entire Simpson peninsula, and the east side of Boothia peninsula and Somerset island. To the north these two belts apparently join on Cornwallis and Devon islands, while the eastern is probably continuous with the limestones and sandstones on the northwest side of Baffin island. These rocks have all been referred by earlier explorers to the Silurian.

On the east side of Melville peninsula, occurs an area about one hundred miles in length reported by Parry as underlain by sandstone. These rocks are apparently very similar to the sandstones found further north on the east side of Prince Regent inlet.

Islands in Hudson Bay

The southern and western parts of Southampton island are underlain by flat-lying beds of light-coloured limestone. Along the northeastern side of the island runs a belt of older crystalline rocks, which can be well differentiated

Belcher Islands

Aerial view over the Belcher islands, Hudson bay, taken by Royal Canadian Air Force.

from the limestones by the ruggedness of the country they underlie. Low collected a considerable number of fossils from the beds forming the southern half of the west coast of the island. An examination of these fossils showed that the bed ranged in age from the Ordovician to high in the Silurian.

Low assumed from the even nature of the bottom in Fisher strait, that these limestones continued without a break to Coats island, where they underlie the entire island except for a narrow ridge of granitic rocks near the northeast end. A few fossils collected from Mansel island show the limestones of which it is composed to be of similar age to those found on Southampton.

Very little is known of Salisbury, Nottingham, and Mill islands, except that from their rugged appearance there is very little doubt that they are composed of earlier crystalline rocks, probably granitic and gneissic rocks similar to those found on adjacent islands.

Although, perhaps, strictly not a part of the area under discussion, it is proposed to make brief mention of Belcher islands. The rocks occurring on these islands are a series of little altered sediments capped by sheet-like bodies of diabase; in places they appear to rest on a basic igneous mass, and at various horizons are cut by sills and dikes of diabase. This complete assemblage is without doubt Pre-Cambrian. The sedimentary rocks vary considerably in composition, and contain numerous beds rich in iron. These iron-rich strata have been examined a number of times by those interested in their development, but to date no work of a serious nature has been undertaken.

Conclusion

As noted earlier in this short article, countless miles of shoreline have never known the blow of a geologist's hammer, and many years will probably elapse before this region is as well known as even the northern parts of the mainland. Our present knowledge of the geology of this northern archipelago is due in large part to the keen observations and tireless recording of men who were not geologists by training, as well as the work of those geologists who latterly have accompanied most of the major expeditions.

APPENDIX A

ZOOLOGICAL COLLECTING AND RESEARCH IN THE ARCTIC REGIONS

By J. Dewey Soper, Investigator, Department of the Interior

The polar region, like many another large area, possesses many peculiar characteristics. A pre-knowledge of these, if not absolutely essential, is still of enormous advantage to any field naturalist bound for the region north of the tree limit. The newcomer is necessarily faced at all seasons by circumstances that are strange, and the writer appreciating this fact, has prepared these notes on the subject which will doubtless be of value to future workers in the high latitudes. Many elect to assail the Arctic regions only during the summer. This time is relatively mellow, inviting, and brief in comparison with the remaining seasons, but the chief purpose of the following observations is to acquaint the traveller as briefly as possible with year-round zoological activities.

Orthodox methods of collecting and preserving form part of every naturalist's knowledge. Of almost equal importance is a specialized knowledge of local conditions—as these relate to the seasons, methods of travel, items of equipment, and peculiarities of the field which have a practical bearing upon the success of the work.

The Seasons

The spring and summer of northern latitudes is clearly the harvest time of the naturalist-collector. Unfortunately the Arctic summer is very brief and therefore calls for enormous effort crammed into a limited period. Long hours of work are involved and intense personal activity. But it will delight the devotee of the strenuous life. Best of all, in the well-favoured regions the season offers abounding rewards, for rich chances come thick and fast—faster than any small party can hope to embrace. In many places there is a truly bewildering abundance of wild life. This actuality contradicts the popular conception of a lifeless polar void.

Some wit has remarked that the Far North consists of two seasons, July and winter. In point of fact, the winter may be said to last from late September until early June. This will substantially apply to most of the southern Arctic. Farther north the winter is progressively longer with the mounting latitudes and still further shortens the summer. Snowfalls may occur any month, but these are comparatively rare during July and August, if they occur at all. Late in the latter month and any time during September snow may fall, but it usually disappears in a few hours under the warmth of the declining sun. Lasting snowfalls at times mantle the country by mid-September, though they are not typical until late in the month, or during the first week of October. At the latter time the small lakes freeze over. This is especially typical of conditions in Baffin island, northern Quebec, Labrador, and the lands immediately north and northwest of Hudson bay. Winter comes earlier and stays longer in the more northern lands of the Canadian Arctic Archipelago.

The first evidences of spring steal over the sub-Arctic areas sometime during mid-May. There are mild spells and thwarting setbacks, a laggardly advance and retreat of the promised season until winter finally ends; this is usually marked by a few grim gales and lingering snowfalls even as late as the middle of June. Then with the magical rapidity of the Arctic spring, peace, beauty, and the manifold endowments of migratory wild life settle upon the land like a benediction. Earlier than this, but now in particular, the naturalist's life of strenuous activity begins.

Ripe summer may be regarded as commencing in early July to continue until mid-August. Then the young birds are largely awing, and the legions of diminutive Arctic flowers near the end of their maximum development. The first consistently regular night frosts set in and the small willows, dwarf birch, and other plants present the flaming foliage typical of autumn days. While they last, the late spring, summer, and early fall days—all crowded into three brief months—are glamorous and delightful beyond all description. At the same time, even in midsummer, periods of sullen, cold, and boisterous weather rob the season of some of its singular appeal.

Seasonal Activities

To those from the "outside" who rely solely upon summer expeditions for zoological research, the richest, most valuable, and stimulating period of the Arctic year is a closed book. Ships usually find it impossible on account of field-ice to approach Arctic coasts until late July or early August. The best is then over; there is, of course, opportunity to collect the rank and file of indigenous fauna after that date, but the remaining open season before ships must withdraw, or be frozen in for the winter, is very short. In general the unbalanced results of this time are but a pale reflection of the potentialities presented by spring and early summer. During the spring migration of birds the tide of opportunity is at the full. Later the bird life is more scattered and less in evidence; many species noted during the spring migration do not nest over large areas of the southern Arctic islands and may not, furthermore, be seen during the return movement southward.

The late visitor to the scene misses the migration of birds, their mating and nesting; there is a wealth, almost indescribable, in the revealing continuity of seasonal phenomena inseparable from the throbbing days of spring. This the serious ornithologist can scarcely afford to miss; this is particularly true if he designs to specialize in a study of Arctic bird life, which in major aspects is of circumpolar similarity.

For broad results in this field of research, therefore, the investigator is obliged to enter the country on one of the annual ships and remain for the winter. This ensures opportunity for observing the very earliest manifestations of spring. Naturally one year may not, and likely will not, be enough for an adequate study of the biota of any given region; but the basic requirement in any event is residence in the territory throughout one or more years. Running the gamut of the seasons the ground will be fully covered.

The above will be the case in any of the islands of the Canadian Arctic Archipelago until such time as aeroplanes are available for penetration during early spring; this means not later than early May. Landings would be effected on skis, as winter conditions still persist. Owing to fogs and gales, however, flying conditions are uncertain and hazardous most of the year anywhere north of Hudson bay and strait. Granted the occasional possibility of early spring arrival by aeroplane, the naturalist can make a very comprehensive survey of the animal life from this period until fall, especially over several seasons. But in passing it must be stressed that the winter months always afford some rare opportunities for collecting mammals; such mammals include caribou, Arctic hare and weasel, white fox, polar bear, and several species of seals. Except for a thorough study of seasonal change of pelage, however, most of these are secured with more convenience and less hardship during the milder months of the year.

At the present time there are no ordinary housing facilities for scientists in the Canadian Arctic. All efforts in this direction will take on the complexion of straight expedition work. In the event of the zoologist being attached to a wintering ship, the latter normally becomes home and workshop. Otherwise a

single worker, or a very small party, may through the courtesy of one of the trading companies be able to secure quarters at one of their northern posts. These are situated at various points along the Labrador coast, Hudson strait and bay, Southampton, Baffin and Devon islands. None exists on Melville, Ellesmere and other polar islands of the Eastern Arctic. Here investigations would necessarily be carried out under greater handicaps as to housing and regional conditions, and would require the erection of scientific quarters for the winter. To effect this a specially chartered vessel would be necessary, which would normally withdraw to return for the party one or more years later. Far-flung detachments of the Royal Canadian Mounted Police are located on Baffin, Devon, and Ellesmere islands, as well as along Hudson strait and bay.

General Equipment

Assuming that suitable headquarters of some description are acquired, the next important consideration is that of equipment. It is not necessary to enter into a description of instruments and materials for zoological collecting as this is standard equipment little affected by region.

Field conditions alter so radically from place to place, however, that wise selection of general field equipment is of paramount importance. In fact, success may depend almost as much upon this as upon a knowledge of actual collecting. Except during the winter when snowhouses are used exclusively, much of one's life is spent in the open, or under canvas, far removed from headquarters. A reliable shelter is therefore of some concern; it is urged that this be of very strongly-constructed heavy-weight canvas, of the wall-tent variety, to withstand the violent gales common to polar regions; 10-ounce walls and 12-ounce roof will successfully withstand a deluge of rain whipped before gales developing velocities of well up to 100 miles per hour. Nothing smaller than 8 by 10 or 10 by 12 foot tents should be taken in order to provide sufficient working room and shelter for field equipment. Telescopic steel poles have been found satisfactory, and much more compact than wooden ones of sufficient tensile strength.

Only occasionally is weight a very serious matter; at the season when tents and other bulky equipment are carried, water transportation is available to make nice discrimination unnecessary. It is a poor policy to rely on cheap, light-weight tents when much is at stake in safety of specimens, instruments, personal comfort, and related efficiency. On a long interior expedition in Baffin island, in 1925, the writer found silk inadequate to the stress and strain of great gales on the open tundra, which resulted in enormous rips and complete collapse on several occasions under very trying conditions. In addition to this lack of strength the fabric is very noisy. All this is unfortunate, as silk admits twice as much good working light as canvas.

Naturalists' and sportsmen's armament is normally a topic of perennial interest and discussion. With the bewildering array of arms available on the market to-day, the inexperienced may well welcome a little advice as to suitable selection. This will naturally change somewhat from place to place in keeping with the game to be taken—more so with the rifle than the gun.

In the writer's opinion any reputable, modern, high-power rifle will render honest service on any North American big game if properly held. In the course of a long term of field work several makes and various calibres have been used in the successful collection of most species of big game in Canada, ranging from antelope to buffalo and polar bear; all have been taken with an ordinary 30-30 carbine. For work on open plains and tundra, however, the necessity came to be felt for a rifle of greater velocity and flatter trajectory. For this reason a ·256 (6·5 mm.) rifle, equipped with a peep-sight was purchased. This rifle

with set and hair-triggers has fine lines and performance, shocking power beyond indication of calibre, and a point-blank range of about 200 yards. On the writer's last two Arctic expeditions it came unreservedly to the fore and was used exclusively on the larger game. Of late years there has been an overwhelming switch to the high-power, bolt-action rifle. Requirements are longer range, flatter trajectory, and more killing power, and these essentials for open country hunting are not found in any of the lever-action rifles of to-day. As one authority has aptly remarked, "It makes no difference what you hunt, whether it be rabbits or moose, carry a rifle with sufficient shock to put your game down and keep it down. Kill it; don't torture it."

A Noon Halt for Observation Purposes on Baffin Island

This picture shows the equipment used by Mr. J. D. Soper, scientific observer for the Department of the Interior, during a winter expedition in the Arctic.

On the whole the shotgun is of much greater importance to the general collector than a rifle, inasmuch as by far the greater number of forms are secured with it. In the busy season it is a constant companion, whereas the rifle is only used on special and usually well-spaced occasions when big game hunting is definitely pursued.

In wooded country there may well be considerable latitude in the choice of shotguns of various gauges. This is at once apparent as between collecting under primeval conditions and in well-settled country more or less under cultivation. In the former case a large gauge is required, while in the latter an ornithologist could possibly collect representatives of 95 per cent of the local avifauna with nothing larger than a ·410 shotgun. Beyond the tree limit, however, there can logically be but one choice, and that a 12-gauge, double-barrel. Seafowl shooting admits of nothing smaller and there are times when one feels that a 10-gauge would give better performance. This is especially true of duck

and goose shooting on the open tundra. Except perhaps for a few isolated cases, the 12-gauge is quite adequate, particularly if the precaution is taken to stock up well with long-range ammunition.

For the smaller birds and mammals, part of the equipment of every collector is an auxiliary barrel to take a small shell loaded with No. 10, or dust shot; this is inserted when wanted into the right barrel of the 12-gauge gun. Many naturalists use a ·32 calibre shell for this purpose; in the forest it serves the purpose well. But in the Arctic the writer has always used a ·410 adapter, which is considered superior owing to better range and penetration. These factors are important in the open country where cover is utterly lacking and where the latter attachment constantly demonstrates its advantages.

Another favourable feature of the ·410 " aux " shell is the fact that it may be obtained in any quantity factory-loaded. This obviates the necessity of spending valuable time in the rush season hand-loading smaller, non-standard shells. An abundant supply of both 12-gauge and ·410 calibre shells is necessary, as large quantities are usually expended at the height of the season. The former should carry standard shot loads ranging from No. 2 to $7\frac{1}{2}$, while the latter may have, loads of $7\frac{1}{2}$, 10, and dust shot. In the ·410 shell the No. 10 shot charge is the most frequently used, as the Arctic lacks the extremely small passerines characteristic of wooded territory.

Probably another item of interest in favour of the ·410 shell is the fact that in the writer's armament, for example, it is interchangeable in three different weapons—the ·410 " aux," a Gamegetter, and a double-barrel ·410 shotgun. This simplifies the ammunition carried for a variety of arms used under varying circumstances. There are times when even the sturdy ·410 " aux " shell falls down for the smaller shy species of the tundra, so that a full 12-gauge charge of No. 10 shot is required. A certain percentage of such shells should be ordered from the factory when outfitting for the expedition. This has been gone into with some detail as arms and ammunition are extremely important in this field.

During the winter months all firearms employed should have the manipulated parts carefully bound with adhesive tape; at very low temperatures bare fingers on naked metal freeze with astonishing rapidity, and while not necessarily serious, it is obviously uncomfortable and tends to lower one's efficiency. The same is practised by Arctic geographers on the contact parts of all surveying instruments.

A choice of the indispensable field glass is an easy matter in this day of excellent binoculars. In forest observation where range of sight is usually short and much actinic light is absorbed by the green foliage, it may be preferable to invest in a lower magnification than eight-power to obtain increased illumination. On the tundra this ceases to be a consideration; light comes freely from all points. An 8-power, therefore, probably has as much or more direct illumination here than a four- or six-power in the woods, with the desirable benefit of higher magnification. Beyond 8-power, however, the glass becomes heavier and harder to hold steady, while the increased power is not really necessary in day-to-day field work.

No expedition nowadays would be considered complete without adequate photographic equipment. This may include instruments for special " still " work, as well as a motion-picture outfit. The naturalist should normally give his chief attention to a good camera for general work. This is almost ideally met by a 4 by 5 inch, long-focus, graflex camera, though the weight of the instrument is sometimes distinctly against it. With fine accuracy and facility it records a wealth of subjects of special interest to the naturalist and becomes a tool in daily use, in importance second only to the gun and pen.

A large number of photographs will be taken with it as a "hand camera," made possible, without loss of desired definition by fast anastigmat lens and focal plane shutter. In fact, numerous subjects will be secured in no other manner and will owe their photographic existence directly to these available features. On the other hand, certain short-range subjects demand a tripod, small aperture, and time exposure. Such examples are floral, nest-and-egg, pictures where fine detail is inseparable from good depth of focus. As to exposure, there is no better guide obtainable than a reliable photographic exposure calculator or one of the more modern exposure meters. With some study and a little experiment for very unusual subjects, the calculator becomes practically infallible.

For many years the writer has consistently adhered in all nature work to the use of panchromatic cut films, available in the larger professional sizes. It entails the slow transfer of the medium in a changing-bag from and to septums of the magazine, but this necessary inconvenience is in most phases of photography offset by superior results. Recently, panchromatic roll-film and film-pack have been introduced in the 4 by 5 inch size. If a smaller camera is used, super-sensitive panchromatic film can now also be obtained in rolls. This film is so manufactured as to be best exposed in conjunction with light filters regardless of subject. K 1 and K 2 filters are most useful to the field naturalist; K 1 being the most rapid, with sufficient correction for most subjects with which he deals, is naturally the one most frequently used. In some classes of landscape photography the mist intervening in the great aerial distances between lens and object to be photographed is a very serious difficulty, and a strong contrast filter such as the "G" filter is a great advantage. In fine weather, however, the Arctic atmosphere is usually very clear.

Motion pictures of wild life are always most desirable; but for the hard-working museum collector worthwhile opportunities in this line appear with relative rarity unless he devotes more time to making his opportunities than urgent regular duties really warrant. In some instances, however, especially while working about great seafowl resorts, good motion pictures can be obtained with little impingement upon the main line of work.

In passing there is one more point. On long walking trips in difficult country where the large camera is an impossible item of impedimenta, photography and collecting can be advantageously combined by carrying a small camera. Several excellent instruments meet the situation and with careful handling of the film, will account for many a photographic treasure otherwise lost beyond recall. In some cases where valuable subject matter is known to exist, it is desirable to take the heavier instrument with one of the Eskimo assistants as camera-bearer.

On long, year-round expeditions to the Arctic, with but an annual opportunity to send out films for development, it is best for the field worker to provide himself with the necessary developing outfit to do this as regularly as possible. Ordinarily he will return to headquarters with sufficient frequency for this purpose to obviate the necessity of development in the field. If he has not already acquired the art he should do so at once. Films depreciate in quality after exposure and before development; of greater urgency is periodic check-up of results to ascertain the possible existence of light leaks, or faulty shutter. If discovered through regular development of negatives, repairs can be made to save the frustration of one's photographic hopes over a considerable period of time. In remote and unexplored country the value of the results is not to be lightly considered.

Sufficient restful sleep in expeditionary work is a first necessity; without it there is sure to be a falling off of that most valuable of assets—bubbling energy. This is attained on the "barrens" by the use of a maximum weight

eiderdown robe of first quality; any saving here is false economy. Its use applies to all seasons of the year, as the nights are cool, or cold, even throughout the summer. The degree of comforting warmth required can be regulated by the amount of clothing worn during the night. Insulation from ground cold can be positively assured by the use of one or more caribou skins below, according to season. One requires as much (if not more) protection under one as over. During winter more sleep is needed than in summer. It is strange, though true, and fully borne out by personal experience, that during summer under the influence of the midnight sun, considerably less sleep and rest is required than at any other time. There is nothing unusual at this attractive season in keeping fresh, energetic, and busy from 6 a.m. until midnight over a protracted period of time.

Clothing

On the whole it is the part of wisdom to follow native example in the matter of clothing. In the northern latitudes dress is of great importance and can and does bear acutely upon efficiency and even upon certain phases of success. This is particularly true during winter. There is no suitable substitute known to the writer for caribou skin garments and ground robes during cold weather explorations. The most important of the former include "kuletuk" (parka) and trousers. These may consist of a double suit—one with hair in next the body and the other with hair out. This combination snaps its fingers at extremes of polar cold. Or a single caribou skin suit, hair out, may be worn over conventional woollen garments; this is ordinarily all that is necessary and identical with the outfit adopted by the writer during thousands of miles of winter travel.

The lower extremities are protected by a caribou-skin, knee-high sock, wherein the bare feet are placed in direct contact with the hair. Sometimes it requires a trip to convince a man that in this, as in many other points, the Eskimos are correct. Ankle-high moccasins of caribou skin, or duffel, or both, are drawn over these and surmounted by the usual winter "kummiks"—a special brand of native boot. One cannot be too emphatic in the advice to follow the Eskimo rule of devoting great care to dressing the feet; it pays. The hands are protected by caribou skin mittens single or double, according to the weather. One pair of these with woollen or duffel "inners" is usually all that is necessary if a man is reasonably active.

On the whole, summer clothing for the Far North may be safely left to personal preference. This clothing may take the form of ordinary field garments. In active work this will be ample on the land. But at sea even at the height of summer, to the uninitiated it is unexpectedly cold and calls for different tactics. Woollen underclothing will be worn at all seasons by the most hardy. Regardless of these garments, sea travel demands a heavy duffel parka, preferably with an outer windbreaker of drill, or moleskin fabric. Thick trousers of wind-resisting material are also necessary. As to any kind of factory-made boots—leave them behind. At all times from early spring until winter the feet will be encased in the Eskimo's famous water-proof sealskin boot, or "kummik," filled with warm all-wool socks and duffels. Ample filling is needed not only for warmth but to absorb shock in rough overland travel. All special clothing for the region, skin or otherwise, is made locally by the Eskimo women.

Field Methods

This paper has nothing to do with information bearing upon the approved technique of current zoological practice, the principles of which are common knowledge to collectors and in their essentials apply with equal force in almost any place in the world. The art of collecting and preserving in more southern

latitudes remains practically the same for the Far North. It is always desirable to have a good text book along to refresh the memory on the less easily remembered methods and formulas. For combined completeness and compactness, lightness and special usefulness in the field, the writer knows of nothing superior to Dr. R. M. Anderson's *Methods of Collecting and Preserving Vertebrate Animals.* Aside from technical considerations, however, strange regions modify the worker's outlook and efforts by a demand for special field methods. This assertion may rationally be made at once: No zoologist will attempt protracted labours in the Arctic without the assistance of Eskimos. This assistance is more important than appears at first glance. It ranks almost equal to the investigator's own special knowledge, his pluck, determination, and otherwise suitable endowments of character and equipment.

Entirely too much rubbish has been written about the Eskimos. Numerous fallacious notions will eventually be dissipated by intelligent interpretation; the only requirements are accurate knowledge and sympathetic understanding. Whatever else they may be, they are honest, intelligent, conscientious, hard-working, entirely adequate, and beyond all chance of assertions to the contrary, the naturalist's most valuable ally in "the lands forlorn." They have a very special knowledge of the ways and resorts of Arctic wild life; this speaks for itself. In addition they are soaked in tundracraft and sea knowledge, and in the first six months will probably by quiet example and method save the traveller from many possible mishaps and serious inconveniences, although he may not realize this till later on.

The first thing to do upon entering the country is to engage at least one good native for a year. As others are required for special occasions they may be temporarily engaged. One's *major domo* then functions as special body servant, dog driver, and sea pilot. The white man is ordinarily impotent here with no special knowledge of either the Eskimo dog, or the treacheries of salt water. The writer personally knows of no "white" in the Eastern Arctic who seriously and habitually travels land and sea by his own unsupported wits—drives his own dogs and manages his own boat. True it may be done; at long last he may be wise in these ways, but he will be wiser still to reinforce his understanding with that of the Eskimos. Not the least important benefit is the fact that the native helper saves for the naturalist time most precious in the busy pattern of the seasons, which is true economy.

If the worker proposes to travel alone with the Eskimos without an interpreter (as the writer has invariably done) it will be necessary to acquire at least a modest command of the language. The eastern Eskimos make no effort to learn English, so that the full responsibility of social intercourse falls upon the "outsider." The native language is very difficult, so that one cannot hope to become proficient until after many years of study. In this case it is only a means to an end, probably only for a limited time never to be needed again. Then obviously it is unnecessary for the naturalist to go to great lengths; a working vocabulary of a few hundred familiar terms is all that is required to intelligently direct the business of the field.

Not the least esteemed among the functions of the native is his unrivaled ability to secure game of all kinds for the scientific collection. He will, for example do this with ease in the case of sea mammals when the newcomer stands helpless. Besides, he is an expert flayer of specimens and after suitable instructions as to museum requirements may be safely entrusted with any job from seafowl to polar bears. Indeed, with his superior patience, he is not unlikely to produce better results than the collector himself. The quick and efficient removal of blubber and tissue from the skins of sea mammals and water birds is not in itself an easy task. The above remarks afford some notion of the value of these men at all seasons.

It is quite unnecessary to state that the zoologist does not escape work by these methods; he simply multiplies himself. Fortunately located, he will on the contrary, be the busiest man in camp. The efficacy of the arrangement leaves the field-naturalist free from the necessity of skinning, salting, and packing the bulkier specimens; this releases time and energy for the performance of numerous tasks beyond a native's ability and comprehension. Any field day, for example, embraces taking and preserving the smaller species as completed study skins, photography, barometric and thermometric observations, sketching, writing, packing of delicate material, and botanical and entomological collecting in conjunction with a study of ecological conditions. No marvel, indeed, that the naturalist sometimes longs for the physical properties of several men in discharging his own inescapable duties.

The earliest migrants to the tundra are the snow-buntings. The more intrepid venture in as early as late April, or before; the main contingent, however, finds conditions uncongenial until the third or last week of May. This is closely trailed by the purple sandpiper migration. But the mad push of the main host of mixed species is usually deferred until about June 10. In favourable resorts—commonly indicated by suitable nesting grounds for a majority of species—the countryside then teems with bird life. In unexplored regions a large daily intake of notes and specimens, new and of profound scientific value, is the rule rather than the exception. To a marked degree, however, these realizations depend upon the skill with which the summer working area has been selected. Here again the Eskimos are of great value. Areas of supreme faunal contrast frequently lie relatively close to each other in polar lands.

From this it is clear that the field-naturalist should be on the job, armed and waiting, by at least late May. If he is fortunate enough to have headquarters in a locality, by indication or repute, of suitable biological promise, all well and good. If not, the program calls for the establishment of a camp elsewhere. This may be twenty or two hundred miles away.

Should a chosen objective be along the coast the matter is relatively simple; one may often travel with a boat in May along the edge of the land-floe, carry over the ice and arrange working quarters for the season on the mainland. Or it may be possible to advance the whole distance with dog-teams on the coast-floe, which may be from a few yards to miles in width, with open sea on one hand and rocky highlands on the other. If travel is deferred until late May there may not be enough snow on the land for satisfactory travel with heavy loads. Great care should be exercised in locality selection as one bad slip may largely ruin a season. The previous winter is invaluable here in exploring out the country, interlaced with Eskimo aid and counsel; the people are reliable and full of information on wild life.

In case the spring-and-summer working locality decided upon lies far inland, or overland to a remote coast, as is not infrequently the case for peak results, plans immediately become somewhat more complicated. The trek will be made with several dog-teams and sleds in early May in order to get good sleding conditions on the land before the break-up. Each sled is capable of transporting about 800 pounds of food and equipment, hauled by twelve to fourteen dogs. A large freighter canoe will necessarily be carried with outboard motor, gasolene and oil to insure summer or fall return by sea, or by rivers and lake-chains across the interior. These alternatives are governed by topographic characteristics and must have earlier minute consideration. Having arrived at the proposed campsite, all the dogs and drivers are sent back. Two Eskimos should be retained as assistants for the summer. All plans in a proposition of this kind must be based on an absence period of not less than three or four months. This expresses a relationship as between time of departure with good sled travel and the opening of navigation with sufficient freedom from ice to insure safe return from the region to headquarters.

Such a thing as natural shelter in the Arctic regions is an unknown quantity; camp will invariably be in the open and exposed to winds of varying violence which may "box the compass" in twenty-four hours. The prime essential is to locate on somewhat elevated terrain (which will always be rocky) with nearby slopes; this insures the run-off of melting snows in June and a dry camp. In setting-up, the snow should be scraped away to smooth bedrock and the tent well anchored with rocks at guy ropes and along the sod cloth inside. Storm guys are necessary from both peaks. A waterproof "tarp" floor promotes comfort and convenience; this is preferable to a sewn-in floor as without breaking camp it may be removed and dried at intervals to prevent mildew. In the beginning, depending upon season, snow walls built about the tents offer effective protection from the winds; with increasing warmth in June they eventually settle and disappear.

THE CANOE IN THE ARCTIC

A canoe provides an ideal means of transportation in some parts of the Arctic during the summer months.

Camp is better composed of two or more tents of moderate dimensions, rather than housing in one large one. These are preferably pitched close together for mutual protection and convenience in camp routine. The Eskimos will occupy one of these, and the naturalist the other, surrounded by his scientific paraphernalia. The latter tent, of course, provides for the naturalist sleeping, eating, and working quarters all rolled into one. This demands decidedly compact and often ingenious arrangement.

A description of personal quarters may not come amiss; this was evolved during the writer's first year of tundra life, with such practical results that the plan has been followed ever since. The bed consists of a strong canvas sheet, doubled and sewn like a bag, open at both ends, 7 feet long and 30 inches wide. This is tightly stretched on two strong, slim poles which are supported

on and temporarily nailed to a provision box at each end. To economize in weight these poles may be mast and boom from the sailing equipment carried against emergency in the big canoe. This plan is superior to lying on the ground. It also affords valuable storage space below. Storage space is always at a premium. The above goes on the left side of the tent. Immediately inside to the left of the entrance two empty provision boxes are tacked together for stability, one above the other, face out. These function as a cupboard for utensils and current provisions. On top goes the small two-burner gasolene stove for cooking purposes. To the right is placed all zoological equipment in its chests along the wall.

This plan leaves a passage the length of the tent. By spanning the space at the back end with packing-case material, a small table is built upon which to dine, skin specimens, and so on. Along the rear edge a small set of shelves is most convenient for text-books and note-books and various odds and ends. Notches cut on the side of the table top will provide a gun stand, butts to the ground. Hammer, saw, and nails are invariably carried for casing specimens, so that the necessary tools are at hand for all such practical and simple conversions. In entering the country, stores and materials are carried in strong boxes; these should be ample in number to be used in turn for prospective collections to be taken out.

By small hook-and-chain device the specimen drying trays are suspended overhead from the ridge-pole for the full length of the tent. Three of these may be hung one above the other over the gas stove. Temporary intervals of heat from preparing meals appreciably hastens the drying process in these trays; they may at intervals be interchanged with others. Specimens once thoroughly dried are best wrapped and packed at once for safety and to afford space for the constant inflow of fresh material.

Probably needless to remark, these arrangements are for a permanent summer collecting base. If happily located it will be in rich, previously unworked territory, to serve a collecting period of weeks or months as circumstances dictate. When local excursions of several days' duration are made from this base, the native tent is taken and the laboratory tent left standing intact; one can then get into rapid action on specimens after the return. The skinning, salting, and packing of the larger specimens performed by the natives is done in their own quarters. The entire party eats in the laboratory tent, as the meals are cooked there in order to direct the heat to the drying of study skins. It is also well to train one of the Eskimos (with clean habits) to cook and prepare meals so as to conserve the chief's time to the utmost. Camp will soon be found to run with efficiency and the minimum of distraction.

A third smaller tent, when possible to transport, is a great convenience for storage of provisions, materials, and boxed specimens. When this is not convenient a heavy waterproof tarpaulin will be required for the purpose. It is draped over the neatly-piled boxes and weighted down all around the edge with rocks on the ground. This is readily opened and closed daily if need be and affords positive protection from the elements. The writer has been forced to leave similar caches on the open tundra for six months or longer without the slightest injury to the contents.

It appears never to have been maintained that Arctic collecting is in any way a sinecure. Circumstances would be noticeably easier and more pleasant if exposure was confined to actual hunting and it were possible to prepare material in a heated building. In a tent there is much that is unavoidably disagreeable. Early in the season it is cold, for in a woodless region no regular warmth can be provided. Normally, sufficient liquid fuel can be transported

only for cooking purposes, so that working hours on specimens are necessarily without heat. Even for absolute needs one must often practise rigid economy to see a long expedition through with properly prepared food.

In the delicate task of preparing small bird and mammal skins the hands naturally suffer most. Much can be done to restore warmth by vigorous swinging of the limbs; fingers may also be warmed up by applying directly to the abdomen, or thawing over a tin of " canned heat " lit at times for the purpose. After a period one becomes more or less inured. Raw, cold spells with high winds visit the Arctic plains and mountains at intervals throughout the summer. Even in July there may be sleet and snow with temperatures ranging near the freezing point.

In any event the body must be warmly clothed in tent work to prevent chill, with sleeves well down over the wrists; woollen wristlets are good and go far to maintain normal circulation and warmth in the hands. Fingerless gloves also have their place. Various expedients will be discovered to mitigate the chill of the less physically active hours. A valuable one is to carefully bank the lower part of the tent outside with moss and peat, or even snow, to reduce air circulation to a minimum; ordinarily a tent is draughty under pressure of high gales and this condition is difficult to prevent. If it is provided with ventilators, the usual pull ropes are ineffective to prevent the cover-flaps from admitting jets of cold air under these conditions; better to sew them shut until at least late June. After this date, if not before, on clear days sun warmth will be felt inside by radiation.

Continuous daylight exists during the Arctic summer. The naturalist may, therefore, devote as many hours as he chooses to various pursuits, and at any time. It is better, however, to draw up a good pre-arranged schedule of daily work, wherein the most suitable hours of the twenty-four are best related to certain tasks. Hunting, may if desired, be followed at all hours, but it will be found better to reserve the brighter and warmer part of the day for preserving specimens; this will be from 10 a.m. or noon, until late afternoon. Except on special occasions, the writer adopted a routine as follows: Up at 5 or 5.30 a.m. and after an early breakfast, all or most of the forenoon given to the field; the entire afternoon was devoted to specimens—sometimes early evening was needed to finish up; after supper an hour or two was customarily spent in the field with the remainder of the evening until bed-time regularly set apart for writing. Under pressure one may again work on specimens after this until midnight, or later. This general plan consistently followed insures a steady output of material and a clearing up of unfinished work for a fresh start in the morning. Specimens collected in the evening are, as a rule best left for preservation until laboratory hours of the following day.

All animals keep well in the fresh, cool air of the high latitudes. In hard, fast travel back to headquarters, birds remain well-preserved for several days if stored in a cool, shaded place aboard boat, or on sled when travelling late in the season by lake or sea ice. Even in the cool, wind-fanned Arctic islands, however, direct exposure to the sun's rays will blister the skins of marine mammals, and start decomposition on small specimens in a relatively short time.

The personal method of recording consists of a day journal in which entries are made on weather, temperatures, explorations, routine elements of interest, physical geography, expanding flora, and general seasonal phenomena from day to day. The majority of notes on birds are preserved in a day book as issued by the National Museum of Canada; in this the names of all species likely to be seen in the region are entered in proper sequence of the check list of the American Ornithologists' Union before leaving for the field and records made by a system of signs and numerals; one small volume lasts for the

entire season. Up to certain limits it is a great time-saver—accurate and comprehensive. More elaborate observations calling for lengthy description, are kept in a loose-leaf ledger under specific, typed headings. All data on mammals are recorded in a similar volume by the same method. There are, of course, the specimen catalogues.

PREPARATION OF ZOOLOGICAL SPECIMENS

Specimens being preserved on the open tundra during a brief halt on the Koukdjuak river in western Baffin island.

As to text-books, selection is naturally limited owing to weight, but a few standard handbooks are indispensible for the field. Those that have been habitually carried under the most trying circumstances are: Chapman's *Handbook of Birds of Eastern North America;* Anthony's *Field Book of North American Mammals;* and Ridgway's *Color Standards and Color Nomenclature.* A few small, pocket-edition volumes of the classics are admissible for random mental relaxation and entertainment. To post headquarters one may, of course, bring by ship as extensive a general library as is desired.

Occasionally it is impossible to transport at once from the region worked during the summer, more than a small part, if any, of the scientific collections which have been made. In work at remote points this has several times occurred during the writer's experience on the tundra. In each case the return was too difficult to attempt the feat with existing facilities. The problem is made even more difficult if fossils are gathered. Under these conditions the only thing to do is to make the collections absolutely secure in cave, or cache of some kind, and return for them with dog-teams the following winter. Thus has some of our most valuable Arctic material finally been brought from the interior to go aboard the annual ship on its way to the museum.

Collecting on the tundra is not always easy and presents some problems of its own; but a resourceful worker will ordinarily find his stride without undue trouble or delay. Most of the smaller species are comparatively easy of approach, while some are downright indifferent. These call for no special tactics. Larger species are usually, though not invariably wary, and require more skill and ingenuity in their capture. It has truly been said that "there is always a way out if one can find it"; baffling situations are made to be overcome, and after sufficient study of the ground and habits of the species concerned, a clear way appears though it may not always be easy. The chief difficulty of flat tundra hunting is in the complete absence of any sort of cover, so that concealment is impossible in an ordinary way.

Around any of the great seafowl nesting cliffs and islands along the coast, specimens are ordinarily taken very readily. Here gulls, terns, guillemots, and ducks may occur in prolific abundance. The big task is not so much acquiring as preserving. One phase of collecting here, however, may be difficult, namely, reaching the nesting resorts during the breeding season which occurs on the average between mid-June and late June. At this time the enormous areas of coast-fast ice are still intact, while the open sea is littered with drifting ice impelled by wind and current. Even with an Eskimo crew, necessary precautions have to be taken in working through the field ice to off-lying islands. During calm weather no risks are incurred as the sea is then like burnished steel amid the slow-moving masses of ice; with ordinary skill a craft is readily manoeuvred through the lanes. Violent gales may find a party on an island, when it is suicide to embark, and thus a sojourn much beyond that originally planned is necessitated. The frequent foulness of Arctic weather, with consequent disorganization of itinerary must be accepted philosophically; nothing can be done about it. Needless to say, tasks will present themselves to abundantly improve the time.

In some districts caribou are not difficult to stalk; they are often easier to secure in winter when herded, than during the summer when more scattered. In the former season they are sometimes absurdly stupid, or curious, and present an easy opportunity. Individual examples of this, however, may be met with at any season. The species has become quite scarce in some parts of the eastern Arctic islands and in consequence harder to hunt down.

Skinning big game animals in winter belongs in a category by itself, calling for speed and skill, especially if several are taken at once. This is cold, unpleasant work and better done with native assistance to shorten the process of measuring and skinning. The writer with one Eskimo once handled the same day, nine caribou, for the National Museum of Canada. This was made possible by skinning the bodies, disjointing the legs at knees and hocks, and then thawing out and finishing the lower legs later at headquarters. With severe sub-zero temperatures the legs of the *cervidae* freeze very rapidly.

Polar bears are secured either at sea while swimming in the water or perched on ice-floes, or hunted down on the coast-floe with the aid of sled-dogs. When a number of the latter are released upon sighting a bear, the animal is obstructed, brought to bay quickly, and bagged without difficulty. Some methods are not very sportsmanlike, but the scientific demand, like that of a hard environment involving life or death, requires the getting of the material in the easiest and quickest manner. All species of seals and walrus, as well as the porpoises, are usually taken with rifle and harpoon; in this work the Eskimos are particularly valuable. Through long training they habitually and successfully resort to ice under apparently dangerous conditions in the pursuit of game, where a white man would not ordinarily dare to follow. At trading posts seals are not infrequently caught in special nets and these have perfect, unfractured skulls. When the rifle is used the *pinnapedia* are almost invariably shot in the head, for which reason a good series of skulls is difficult to obtain.

The Arctic fox and wolf are ordinarily trapped, while the hare is habitually taken with a shotgun, or a ·22 rifle. This animal, however, frequently blunders into fox sets. The Arctic weasel and the two species of lemmings are collected in small mammal traps; in the latter case sets are made across the runways, as neither animal appears to be attracted by bait. With suitable light charges both weasel and lemmings can often be secured with the gun while travelling afoot.

With native assistants the collector, except out of curiosity or to increase his personal experience, is not likely to attempt skinning his specimens of bear, seal, or walrus. The natives will do a better and quicker job and release his energies for other tasks. The Eskimo woman, in particular, is adept in removing the blubber from the hides of any of the marine mammals. Much the easiest way to clean the skulls of these creatures is to suspend them in the sea, where the teeming multitudes of shrimps, or "sea-lice," make a thorough clean-up in a few days. All that is necessary then is to dry the skulls when they are practically ready for the cabinet. Care must be taken to put them in a wire container, or secure them in heavy twine, or the bones will be lost; the lower jaw should invariably be well tied to the cranium under the zygomatic arches.

Numerous species of marine invertebrates are exceedingly plentiful in the polar seas and are readily secured with suitable drag- and hand-nets. The greater part of such collecting is best done from a boat in calm weather in harbours, bays, and off coastal headlands. Fine series may be taken in the fall and spring at the floe-edge, or even at fissures in the ice.

Fish of several species are indigenous to Arctic coasts and lakes; ordinarily these are taken with nets set at strategic points along the coast, or at the mouths of rivers which discharge into the sea. The Arctic char may be collected in quantities in nets, or it may be speared in coastal rivers or through holes in the ice of fresh-water lakes. Others, again, can be secured by "jigging" with a ganghook close to the sea floor. For the best results it appears that the net is preferable for most species. So far as the writer can learn by personal trial and otherwise, Arctic fish do not usually rise to hook and line, or any of the artificial lures, either by casting or trolling.

During the height of summer certain species of insects are quite abundant in the southern Arctic, when it is possible to make large, attractive collections. Spiders appear on the tundra late in May when the snow first melts from the grassy tussocks. By mid-June the *diptera* begin to apear and in the course of two weeks many species become common. The *lepidoptera* of which there are several beautiful examples, find their heyday of existence during July and early August. At certain periods and in well-sheltered valleys comparatively rich in flowering flora, they may be actually abundant. Mosquitoes appear usually in early July, but with the exception of a short time in late July or early August they are seldom very troublesome. For the few days in which they reach maximum abundance, however, "dope" or a head-net will be found desirable. Tents should be provided with a bobbinette front. The Arctic islands are not visited by such a plague of these insects as is the mainland interior to the south.

Winter comes on early in all the higher latitudes. Relatively large numbers of seafowl tarry until the eleventh hour. The zoologist will do well to foresee the possibilities of comprehensive collections at this late date, when the specimens may be temporarily frozen and worked up at leisure during early winter. After late September the dwindling fauna soon reaches the zero hour of the polar lands, and this is maintained throughout the long winter with no more than 10 per cent potentiality as compared with the brief wealth of the summer.

From early October until December is a comparatively profitless time for the traveller by land or sea—a transition period between the close of navigation and practical or safe sled travel anywhere. It is true that the zoological

opportunist may do something in the field of local studies, but possibilities at this time are extremely limited. In addition, it should not be overlooked that this season is thoroughly appropriate for many indoor activities, such as final care of the collections and study of material, amplification of field notes, and all such literary work as will enrich and vividly secure to the naturalist later, facts and impressions of professional value while the manifold influences of the productive months' work are fresh in the memory. Preparations for serious winter travel are necessarily made before Christmas, as outfits leave shortly after with the advent of the first favourable conditions.

Provisions

In long-time expeditionary work, far removed from sources of supplies, the problem of the selection of food assumes important dimensions. The very foundations of health are at stake; it has been aptly said that a man is what he eats. He may literally double his endurance by proper choice of diet alone; or he can double it by exercise alone. The two go together.

In the old days scurvy was the bane of Arctic exploration. This was the result of an unbalanced diet lacking certain essential vitamins—too much dependence placed upon such items as salt pork and hardtack, with insufficient exercise. Whaling crews and scientific expeditions with wrong viewpoints as to the rigours of the polar winter were prone to remain inactive aboard ship. This was all wrong; especially in the lower zones of the Arctic region, the investigator may keep healthfully active in outdoor pursuits throughout the winter. It is a sure antidote for physical deterioration and mental depression. If these facts had been better known and heeded in the past, the polar regions would have seen less of tragedy.

In this era of desiccated vegetables and scientifically prepared tinned foods, suitable selection permits of healthful living in the Far North. An abundance of energizing bulk staples is of first importance, not forgetting the great value of powdered whole milk, cheese, dried beans, butter, desiccated potatoes, and entire wheat flour. The nutritive value of milk and cheese is among the highest of all foods; it is not only high in calcium, but also in phosphorus and vitamin A as well—all life-giving essentials. Oatmeal, nuts, canned and dried fruits, and high-grade preserved meats have special nutritive values.

Briefly, a careful selection of available modern foods of good keeping qualities, enables the explorer to regulate his diet as effectively the year round in the North as in civilization. This coupled with active physical and mental interests, insures glowing vitality, as the polar regions are among the most healthful in the world. Even the common cold is almost unknown.

Rations for the Far North are based on an individual requirement of approximately 100 pounds per month. While at headquarters, or on sea-going trips, one may enjoy all the varied and healthful foods provided. On difficult inland journeys summer or winter, the provision list is necessarily modified; this is with a view to greater simplicity and weight reduction without loss of support. This obviously demands foods that are high in nutritive value for the weight, such as white beans, peameal, powdered milk, dried meats, vegetables, and fruits. In addition there will be butter, biscuits, jam, and tea. From items as above, a highly sustaining pre-cooked and cube-frozen soup may be prepared, which can later be served with utmost facility and economy of fuel. A little knowledge and foresight in this department is all that is needed; remember that an ambition deprived of drive is an idle dream.

It may be taken into account that fresh meat, an additional resource, falls as a matter of course to the collecting zoologist and his assistants. Some dependence may be placed upon this source of supply during the active summer season, which will reduce weight of outfit; but this must not be carried too far.

In some instances, for example, collecting may be confined in special areas to types of seafowl unpalatable to the worker. The Eskimos will eat anything.

During extensive collecting in districts which embrace caribou, hares, geese, ptarmigan, and waders, the camp will ordinarily have an excellent supply of meat. This incidentally confers a benefit upon the Eskimo helpers who are not too happy when confined to "store foods." Caribou meat is especially good, though the writer has very seldom taken these animals for this purpose alone; on several occasions it was necessary to support life after exhaustion of standard supplies. Under such stress there is legal sanction in the Northwest Territories of Canada by virtue of the Northwest Game Act.

A Zoological Collecting Camp in the Arctic Regions

Base camp of Mr. J. Dewey Soper on the east shore of Nettilling lake, Baffin island.

When a large scientific series of caribou, geese, ducks, or ptarmigan is acquired an abundance of meat is immediately available. At rare intervals the larger species come in conspicuous numbers at the same time. The problem then is to save to prevent waste. Deep snowbanks are usually available near camp in which the meat may be refrigerated for gradual consumption until early July. After this it may be kept sweet for a considerable period by submersion in deep, cold water of tundra lakes and streams.

As to water—there is none better; streams are legion, of pure and sparkling quality. In these the water normally continues cold throughout the summer. This applies to the mainland; on many of the bird islands (holding profound interest for the naturalist) drinking water is scarce or absent. By careful search a diminutive spring may be discovered and if a hole is dug in its course a small pool may be created for dipping. Or perhaps a belated snowbank may occur under shaded slope to, or beyond, the time of bird nesting. All failing, fresh ice or water can be brought by boat from the mainland. Where water is found on the insular, congested waterfowl resorts it is often filthy and if not condemned outright, should be strained and boiled before use.

Notes on Travel and Conclusion

Under present conditions the investigator's needs are taken care of by two principal modes of travel—by boat and by dog-sled. The former offers many possibilities; under various circumstances one may, for example, employ canoe, sailing whaleboat, various types of motorboats, or any one of the many kinds of the smaller, deep-keeled, sea-going schooners.

For the more ambitious, itinerant expeditions of many members, a schooner becomes a necessity; it has many advantages and conveniences for this type of exploration. But for a small party it is not necessary or even desirable where much local work is to be done. In many respects the smaller craft has greater flexibility of movement which is a valuable feature. It is true that the larger vessel defies weather that will halt the former, but most of a naturalist's time in the Arctic is devoted to extensive collecting on, or near the land, and not to straining for distant objectives. A small craft is ideal for investigating along the coasts and labyrinthine island passages. These places are faunally rich in comparison with the open sea, where one's chances are progressively poorer the farther out one goes. The small cruiser along the coast carries off the prizes.

During many seasons the writer regularly used a large freighter canoe with outboard motor; after thousands of miles of coast cruising and in and out of scattered ice and keeping in mind the pre-requisites of the zoologist, it is still whole-heartedly preferred by the writer. The outfit is relatively fast, economical, and possessed of no mean sea-worthiness with an effective cruising radius of several hundred miles. The craft is hauled out every night and one sleeps undisturbed, and free from the haunting anxieties of storm and tide, as is the lot of those with anchored craft. While harbours are numerous, they are not always at once available on these iron-bound coasts. With small hauled-out craft this ceases to concern; almost any ledge of a few yards width above high-tide line is suitable.

With the large canoe one may portage and go inland on lake and stream. No intricacy of coast, shallow seas, sequestered bay, fiord, or lagoon, defies the versatility of the light-weight and shallow-draught craft. Rough weather can and does put the small boat out of commission—but there is no excessive hurry. Every halt brings something new to light; and it is just as well to stop frequently as many rare specimens will be secured in this manner.

Effective coastwise travel is possible from about mid-July until well into October. Earlier ventures may be made in June by hauling over and launching from the edge of the coast-floe. Inland waters, especially the smaller lakes, ordinarily freeze over in a single night during late September or early October. The traveller is advised to abandon inland cruising by the third week of September. At any time after this date a lake-chain may freeze and thus cut him off with elaborate equipage a long way from salt water and headquarters.

Regardless of a traveller's duties it is best to instruct a reliable Eskimo in the use of the motor and thus gain uninterrupted freedom for observation. For naturalist-collector, or surveyor, the necessity is obvious. The native has quick mechanical intelligence; very little tuition is required, and none for serious boat management.

Winter travel with dogs and sled usually commences in December. Before this date coastwise ice travel is unsafe, and land travel as yet out of the question except for local runs. An ample wind-packed snow mantle is required for long interior journeys, that rocks may be covered and proper depth assured for snow-house building. At this season a snow igloo is constructed every night on long trips, except when the party is delayed in camp by blizzards. This applies until early May when the igloo is abandoned for the tent. Land travel is normally possible until mid or late May. Progress on the sea-ice is usual

throughout June if desired, though the surface for a period teems disagreeably with pools of water; and leads and fissures, slowly developing, require careful negotiation. The " candle-ice " of this time is also severe on the feet of sled-dogs.

White men plan and organize their undertakings throughout, but normally the Eskimos take the initiative in the actual trips by land or sea; they also have the brunt of responsibility in the care and management of dogs, boats, general equipment, snow-house building, etc. Though the aeroplane is fast winning its way to the heart of the " barrens," the Eskimos and their dogs will long, and perhaps always, remain supreme for detailed investigations on the ground over the Arctic mainland and islands.

In winter explorations no dependence whatever should be placed upon a possible game supply en route, either for men or dogs. This is at the bottom of many a tragedy. On occasion even Eskimos have starved to death in their own country, and the writer is disinclined to believe that a white man will victoriously persist where an Arctic-skilled native will perish. Immense tracts of the less rugged tundra are practicaly lifeless at this season, a fact to be recognized and regretted. But regret will not keep a man alive, and it is hard to sustain a flicker of life on mice, *cetraria,* and rock-tripe in the middle of winter.

Exploratory success is conditional to a substantial degree, upon the transport of all necessities. Travel over the lifeless tundra and over extensive sectors of equally lifeless ocean ice, offers in effect a close parallel. Occasional favoured maritime localities possess " shukbuks," or tide-rips, where seals may be secured; the latter may also be taken off the floe-edge at varying distances from the land. In many cases, however, dependence placed upon hunting en route to acquire dog feed (even where possible) will consume so much time as to virtually ruin plans for particular explorations. In the instances where one is forced to do this he will be advised of the fact before he begins laying plans at all.

The zoologist may rightly inquire, " What benefit is to be derived from going to these gameless areas at all?" In answer it may be said that leaving purely geographic discovery out of account, in unknown country one does not know before going exactly what lies ahead. The motive for going is to find out. And not to know is to be ignorant to that degree of animal distribution and other features. But to consummate these inquiries and return with hard-earned information one must play the safe game. The voice of experience simply dictates as to the existence of gameless areas; and these may be flanked by territory which once penetrated surrenders rich spoils.

It is not improbable that the average visiting naturalist will decline serious consideration of an essentially uninterrupted program of winter travel; it is somewhat expensive, and may not fit in with some other plan of intensive activities. But if to the contrary, he may, with reasonable assurance, hope to cover about 2,000 miles in one winter. This, in terms of ordinary zoological pursuit, is admittedly out of proportion to the result. But it does, nevertheless, pay reasonable dividends of knowledge that may be acquired in no other way. Here as elsewhere, a proper evaluation of probable expeditionary returns takes into consideration the progressive possibilities of every season of the year, and, without crystallizing these by effort into reality, the great mosaic of the unknown continues in at least partial obscurity.